Effectiveness of Directive Feedback using ASSISTments

An Interactive Qualifying Project

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Abstract

This project focuses on two main goals. First is to develop additional contents for the ASSISTments system targeting sixth graders. Second is to compare the efficiencies of directive feedback, i.e. providing hints and explanations, and knowledge of response feedback, i.e. simply informing the students if they are right or wrong, in helping them to master a specific mathematical skill. Each problem is created with identical content yet presented to students in one of two ways: with or without hints. A study was then conducted using these problems sets to acquire data with the goal of determining which method is more effective. For each problem set, students were randomly assigned in either the experimental group, i.e. with hints, or the control group, i.e. without hints. Analysis from the collected data suggests that detail hints play an important role in accelerating the students' process of mastering a skill.

Acknowledgement

We want to dedicate special thanks to Professor Neil Heffernan for leading the project, and to Mrs. Cristina Heffernan for the weekly guidance throughout the three terms. Also thanks to the ASSISTments development team for maintaining ASSISTments system, and helping us to collect the data. Finally, we would like to thank the teachers and students using our skill builders, because without them, the project would not have been possible.

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1. Introduction

The first goal of this Interactive Qualifying Project (IQP) is to create a comprehensive set of variablized templates, which involved skills for sixth graders such as identifying equivalent expressions, writing expressions for real world problems, determining if a value is a solution to an equation or inequality, etc. Even though the ASSISTments system already has some existing problems these skills, they are not variablized and not completely cover the topic. The six different skills are divided equally among the three team members as we seek out to create a new, complete variablized set of problems for the chosen skills.

In addition, we also set up and conduct a study based on these problem sets in order to determine whether directive feedback or knowledge of response feedback is more effective in helping a student understand a particular skill. Our skill builders are constructed in such a way that each student would be randomly assigned problem either with hints or without hints. Next, we can compare the two groups by several factors such as completion percentage, or time spent. By analyzing these data, we can determine which tutoring method is more effective for helping students learn new mathematical concepts. The methodology, analysis process, and results are discussed later in the body of this report.

1.1. ASSISTments system

In 2003, ASSISTments project, an intelligent tutoring system, began as an idea of Neil Heffernan and Ken Koedinger, with the funding from the US Department of Education, the Office of Naval Research and the National Science Foundation. Several thousands of students, mainly located in Maine and Massachusetts, have used ASSISTments. The word "ASSISTments" is a blend of "assistance" and "assessment". While the system effectively helps students to master over a hundred different skills, it gives teachers an effective way of quickly and easily assessing their students' performance. ASSISTments is a full function web-based teaching system that provides tutoring in various areas. Created and

supported by WPI, ASSISTments allows teachers to develop and assign tutoring problems, and to access their performance in a timely manner. In the next section, we will give the general instructions adopting several changes to the system in the last few months.

1.1.1. Developing problem sets

When creating the problem sets, teachers could directly apply the pre-built content inside the system. Under the Builder tab, and then Folders tab, teachers can find hundreds problems from the ASSISTments Certified Problem Sets, or the Shared Problem Sets from other teachers. The pre-built problem sets are well organized in subjects, tutoring methods, grades, etc., which makes it very convenient to find any specific skill.

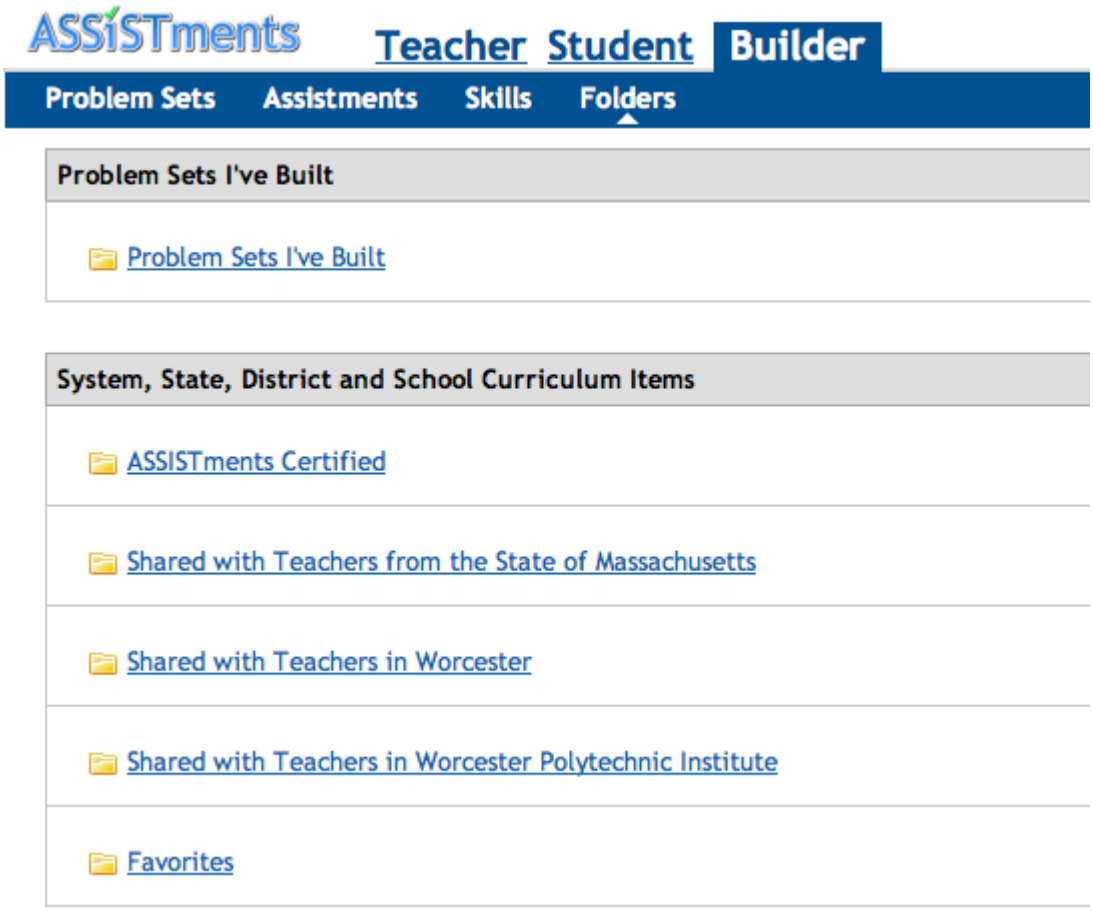


Figure 1: ASSISTments Pre-built Content

Besides, teachers have the option to build their own problem sets from scratch in order to suit their specific tutoring purposes. Under the Builder tab, and then Assistments tab, teachers can access the builder by click on the link Build New Assistment.

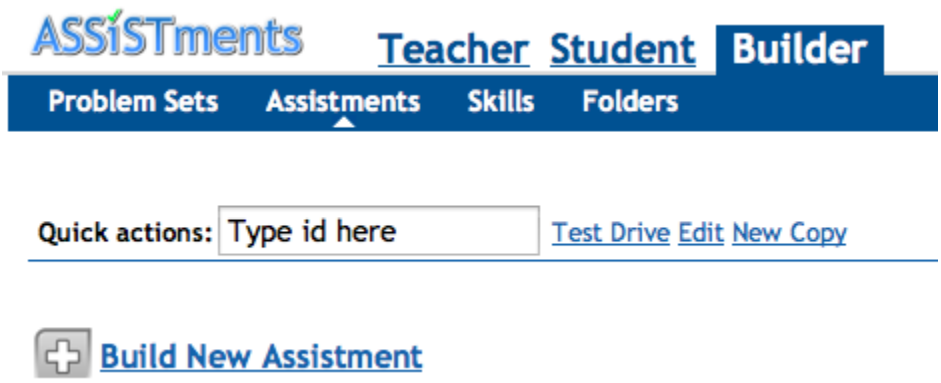


Figure 2: Build a new assistment

The Assistment builder allows the creation of two assistment types:

- Standard assistment: static, all the numbers are fixed.
- Variablized templates: dynamic, including random variables, which different each time a new instantiated assistment is generated.

Moreover, there are several problem types that can be created, depending on the needs:

- Rank
- Fill in
- Check all that apply
- Algebra
- Multiple choice
- Ungraded open response
- Externally processed problems (Flash or Java)

The main problem is constructed in a text editor window, which also allows the input of images or videos. Also, there may be more than one main problem inside a single assistment. The answers and tutoring strategies can be added under their corresponding sections by click on the link New Answer or New Strategy.

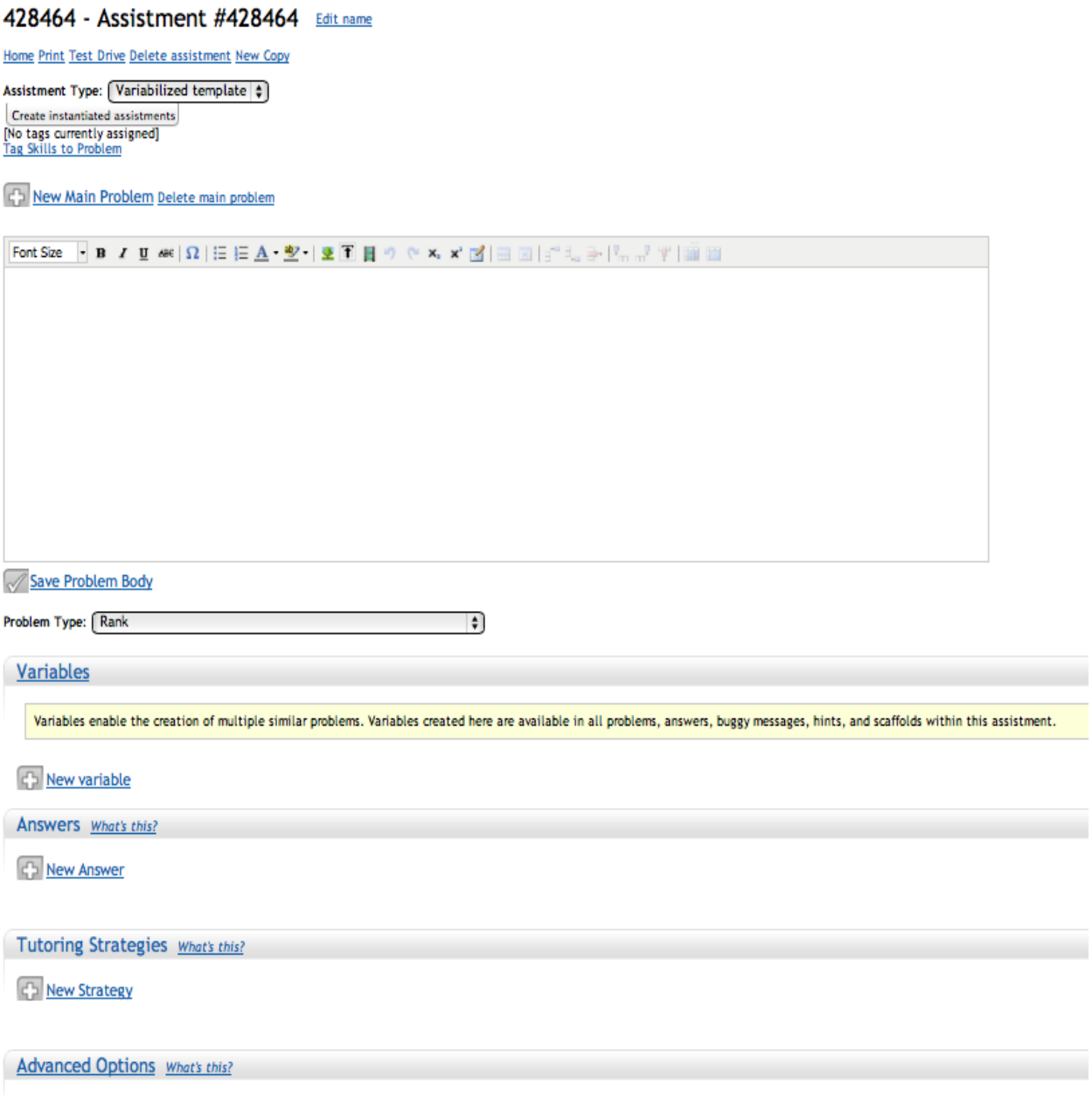


Figure 3: Assistment Creator Window

Next, teachers can create a problem set which contains all the necessary assistments to assign for the students. There are three options to create a new problem set, as shown in Figure 4.

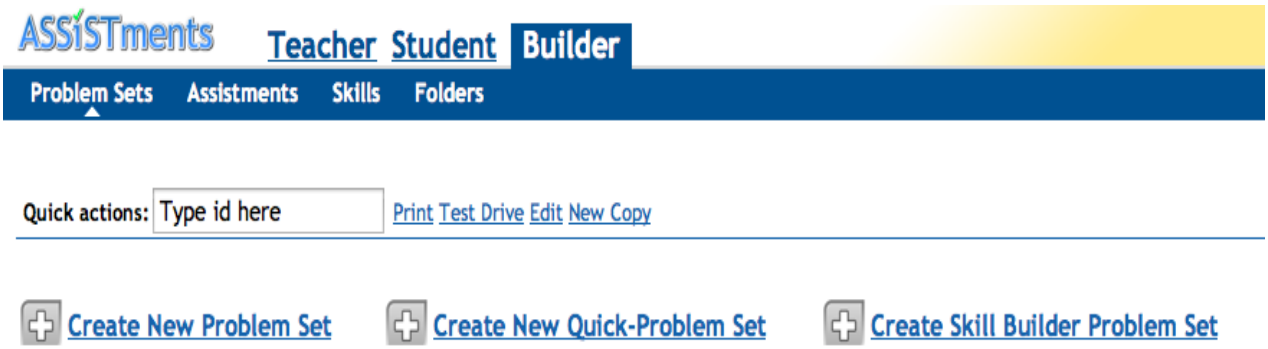


Figure 4: Problem Set Creation Options

For each problem set, there are several settings to be chosen such as Problem Set Type and Assistment Mode in order to fulfill the teachers' tutoring purposes.

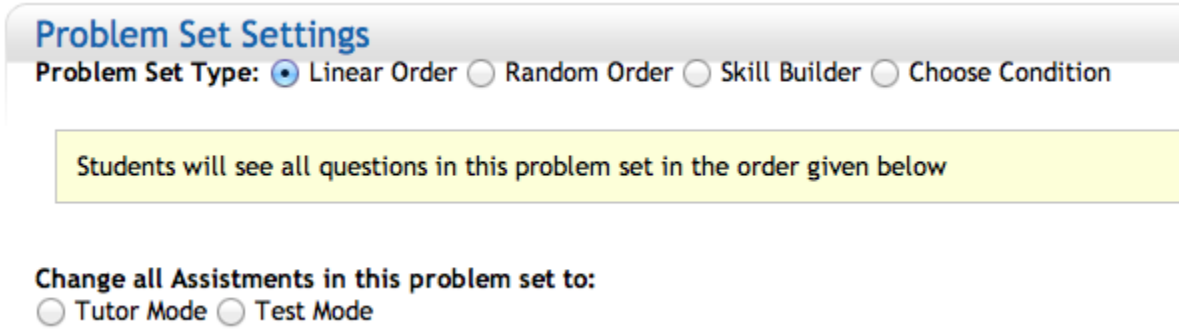


Figure 5: Problem Set Settings

After the creation, these assistments and problem sets could be shared with other teachers through the system. Others can use them directly or modify them for different purposes.

1.1.2. Assigning Problem Sets

Teachers can easily assign problem sets to students under the tab Teacher. Teachers have the option to add a new class or edit the class information at any time. To assign problems to a specific class, teachers have to click on the Assignments link inside that class and choose the problem sets they want.

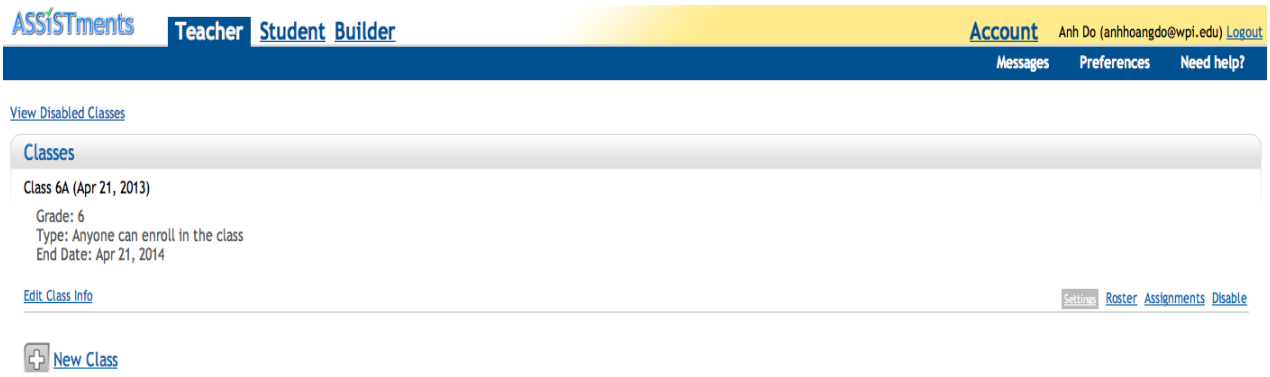


Figure 6: Classes Manager in Assistments

Once the problem set is assigned, teachers can edit the release date and the due date according to their plans. They are also able to check the class progress on these assignments.

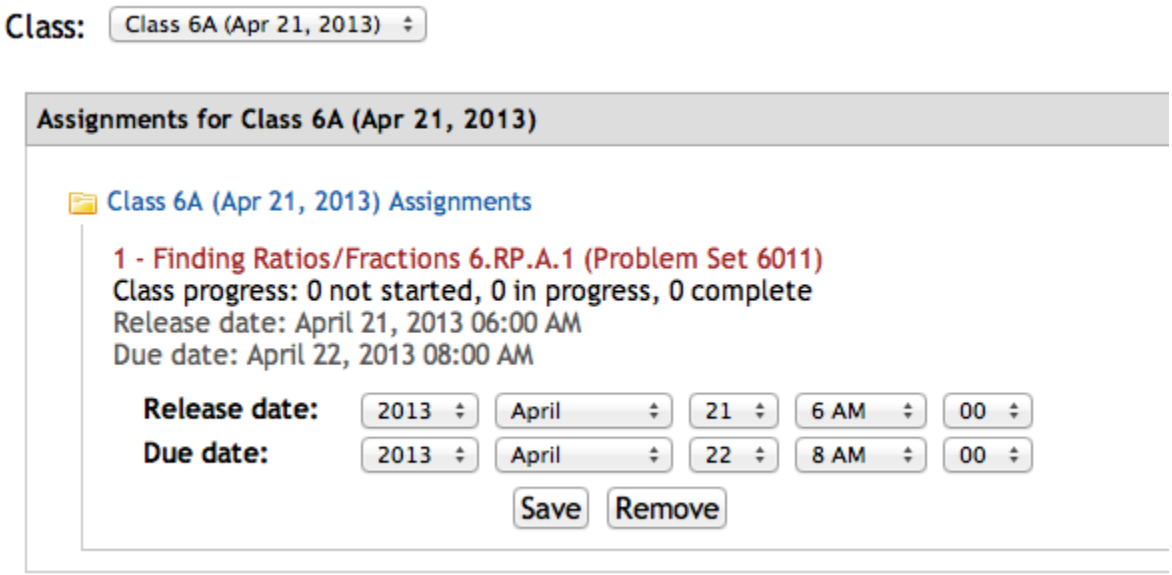


Figure 7: Changing Assignment Release Date/ Due Date

1.1.3. Viewing the Problem Sets

All the students enrolling in a class can see the problem sets that got assigned and their due dates. They can start the problem set any time by clicking on the corresponding link.

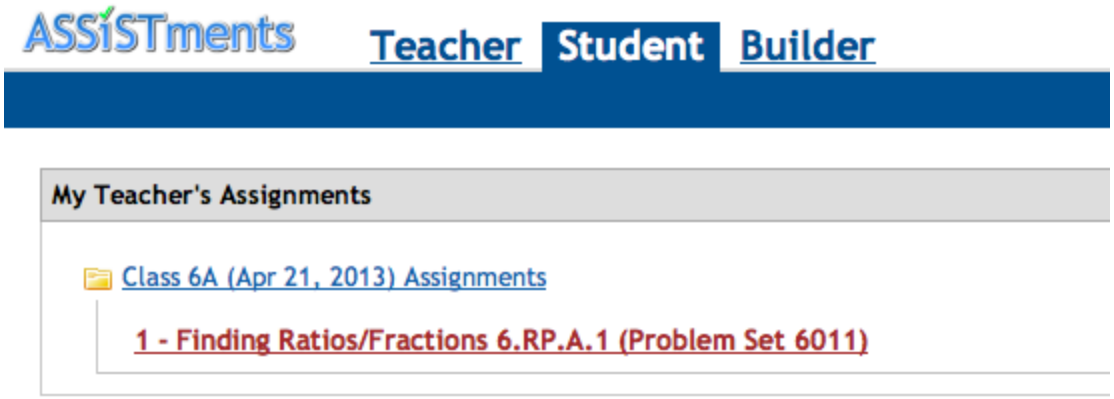


Figure 8: Viewing Students' Assignments

Once the student clicks the link, they will begin the problem set. Depending on the problem set type the teacher set, different conditions are required to fulfill in order to complete the assignment. For our study, all content, which is described later in this report, is set in Skill Builder mode. It means that a student has to get a particular number of questions in-a-row correct to master a skill (typically 3 or 5) before moving to next section. There is also a predetermined daily limit for number of problems a student can try, which in this case is 20.

1.1.4. Assessing the Results

Teachers are able to access the progress of students in a timely manner. For each assignment, teachers can see several types of report.

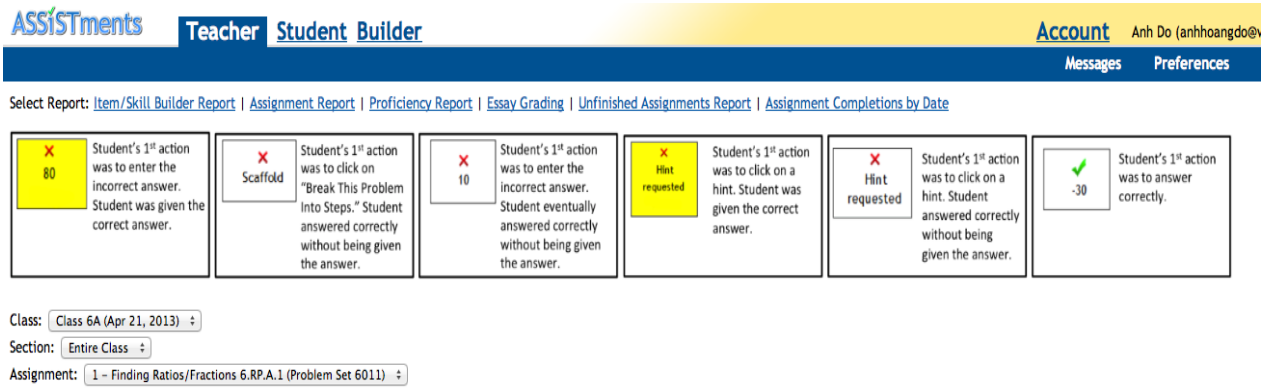


Figure 9: Viewing Class Report

Inside each report, there are several features the teachers can easily access to assess students. Teachers are given each students average as well as the class average. They can see the answer of each student on each individual assistment, whether the answer was correct or incorrect, and whether a student clicks on the hints or not. Moreover, teachers can see the average on a problem by problem basis or for the overall problem set. Additionally, if there are any common wrong answers, the report displays them near the top of the page. This information could be helpful for teachers, because it allows them to see if students are making the same mistakes.

From these reports, teachers can do an analysis for either each student or the whole class on a problem set. Moreover, they can acquire summation analysis of many useful information such as how long each student spent on a problem, how many hints are used, and then estimate how well a student could do on the real test.

1.2. Project Goals

This project has two main objectives. The first one is to develop additional content for the ASSISTments system. In particular, we build problem sets for six different skills of the Common Core Mathematics Standards, targeting sixth graders. In a short term, these problem sets is used to collect data for our study, while in a long term, they enrich the overall tutoring system. The six skills are shown below.

Table 1: Skill Descriptions

Skill	Description
6.EE.A.2a	Write Expressions
6.EE.A.2c	Evaluate Expressions using Order of Operations

6.EE.A.4	Identify Equivalent Expressions
6.EE.B.5	Determine if a value is a solution to an Equation or Inequality
6.EE.B.6	Write Expressions for Real World Situations
6.EE.B.8	Write Inequalities from Real World Situations

The second objective is to conduct a study to resolve whether directive feedback, i.e. providing hints, or knowledge of response feedback, i.e. simply informing right or wrong, is more effective in guiding students to master a skill. Thus, each problem set is created with identical content yet presented to students in one of two ways: with or without hints. For each skill, students are randomly assigned in either one of the two problem sets. Based on their performance, we can analyze the data and conclude which method is more efficient in helping the students to master a skill. Moreover, we can also decide how much interactive feedback or hints is needed for students based on the level of their knowledge in a skill.

2. Content

From the Common Core Standards, we chose six different skills for the targeting 6th graders, to construct our skill builders. Among these six skills, some are very simple, while others may pose real challenges for the students. The difference in level of difficulty can introduce variety in the study we conduct later. To make solid progress and stay organized, we maintain detailed documents on Google document and spreadsheet. Every problem needs to go through three steps to ensure the quality of our work: drafted content, built content, and approved content. The approved content will be sent out to teachers in order to conduct the study.

2.1. Templates Design Process

We spend the first two weeks to familiarize ourselves with the ASSISTments system. During these weeks, we try out some existing problems to see what the students will see when they doing the problem sets. Then, we look at several problems in edit mode to explore how they were created. After that, we construct some simple problems in order to test our understanding before applying to the required templates.

2.1.1. The first phase

In the first phase, we focus on constructing the following three skills, and each team member is responsible for a single skill:

- 6.EE.A.4: Identify Equivalent Expressions (Nghia)
- 6.EE.B.5: Determine if a value is a solution to an Equation or Inequality (Tri)
- 6.EE.B.6: Write Expressions for Real World Situations (Anh)

We start building a drafted content for each skill, with the goal of about ten or more variablized templates. At the beginning, our advisor provided sources and instructions on the standard structure of an assistment problem, as well as the hints. We learn how to include pictures, tables and diagrams in the problems so that they can quickly convey more information to the students.

During the process of building templates, we receive weekly feedback from our advisor on each template on the organization, the grammar, and the level of difficulty. Then, we make the changes according to these feedbacks. Another efficient way of improving our templates is to get opinions or feedbacks from our team members. Since there are only three members in our team and we are all in the processing of learning about the ASSISTments system, each of us can often obtain valuable advices from the other two members.

Next, as the templates are modified according to the feedbacks, we make some refinements about the formatting such as changing the text size, or coloring the variables for a better visualization purpose. Then they are sent to our advisor, waiting for the final approval. If they are approved, they are ready to go into the skill builder. Otherwise, we modify these templates according to the feedbacks until they got the final approval.

2.1.2. The second phase

As we learn a lot when building the templates during the first phase, the second phase pasts quickly as we tackle the remaining three skills. Again, each team member is responsible for a single skill:

- 6.EE.A.2a: Write Expressions (Anh)
- 6.EE.A.2c: Evaluate Expressions using Order of Operations (Nghia)
- 6.EE.B.8: Write Inequalities from Real World Situations (Tri)

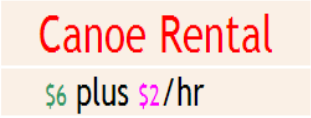
The same procedure is applied for these templates. We build the draft content, and modify the templates according to the weekly feedback from our advisors and peer review from the other two members. When the templates are successfully built, we make some refinements in formatting before submitting them for our advisor's approval. They are ready to go into the skill builder after the approval. Otherwise, modifications are made until all the templates get the approval.

2.1.3. The third phase

For each of the six skills, we create from 8 to 12 variablized templates representing different aspects of that skill. Every template comes with the detail hints to break the problem into step-by-step explanation, guiding the students to the final answer and to gradually master the skill. By the middle of the second term, we get all the approvals for these templates and ready to make the skill builders based on them. Detail implementations for the templates could be found in the Appendix.

In our study, since the students are randomly assigned the problems either with hints or without hints, for each template, we have to make another template with identical content but without any detail hints. These new templates are automatically approved as they are made from the authorized templates. For example, we have an example problem from the skill 6.EE.B.6.

Use the picture below to answer this question.



Marion wants to rent a canoe to go out on a lake. The cost is $6 plus $2 for each hour.

Let n be the number of hours the canoe is rented.

Using numbers, symbols, and the variable *n*, write an expression for how much it would cost to rent the canoe for *n* hours.

Figure 10: A sample problem (Skill 6.EE.B.6)

In the original templates, step-by-step explanations are provided. There are a total of four hints as shown below, guiding the students toward the final answer and help them to understand how to write an expression for this type of problem.

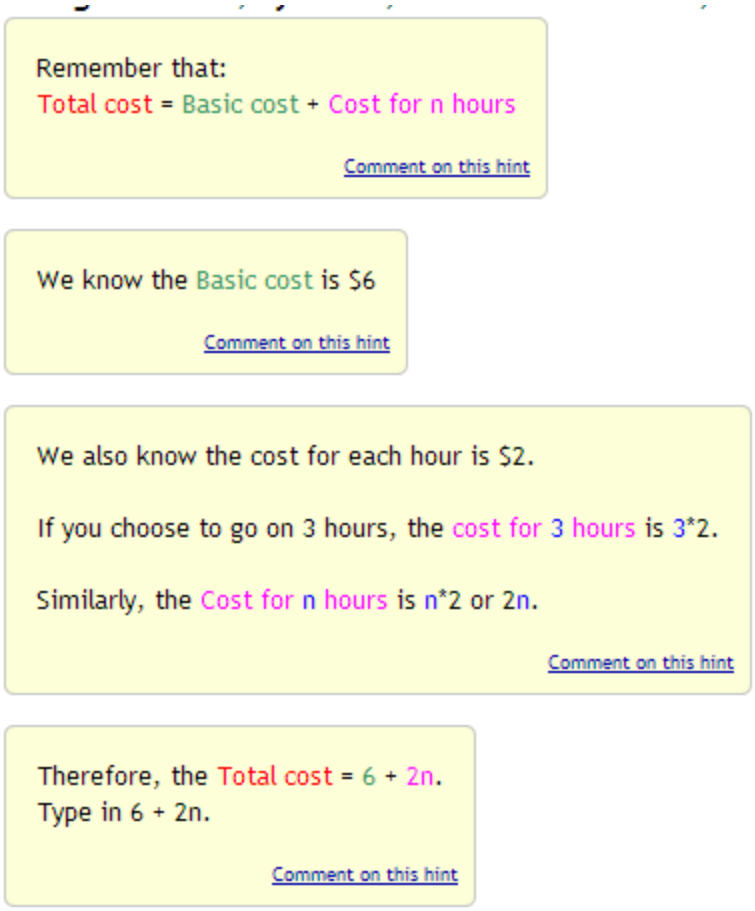


Figure 11: Example Directive Feedback/ Detail hints

For the no-hint templates, only the final answer is given without any further explanation, as shown below. The students know the answer but may not know the detail process of writing an expression for this type of problem.

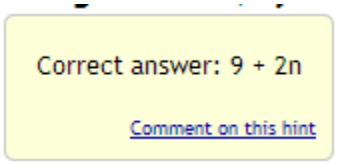


Figure 12: Knowledge of Response Feedback/ Bottom hint

2.1.4. The final phase

At the beginning of each skill builder is a tutorial assistment, which gives the students the standard rules on how to complete the skill builder. Since our entire problem sets are skill builders with the same rules of 3 right answers in-a-row to complete, we need only one standard assistment to explain this concept to the student. This assistment is shown below in Figure 13.

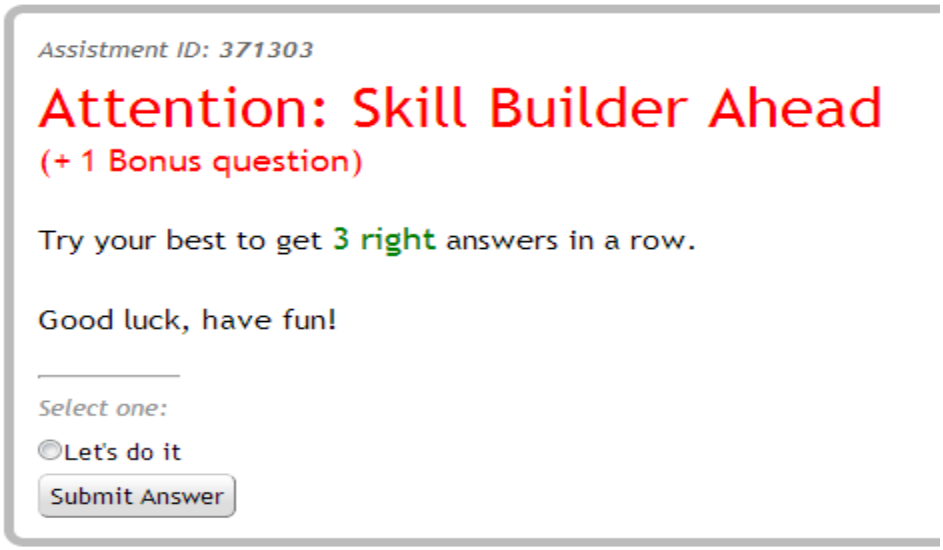


Figure 13: Instruction Assistment

Moreover, we decide that each skill builder will come with a fairly difficult bonus item, a far-transfer item, at the end to further evaluate the students' understanding about each skill. These items are set in test mode so that the students do not have to answer correctly to finish the whole problem set. Student performance on these far-transfer items can provide additional information for our analysis. For example, the far-transfer item for skill 6.EE.B.6 is shown below in Figure 14.

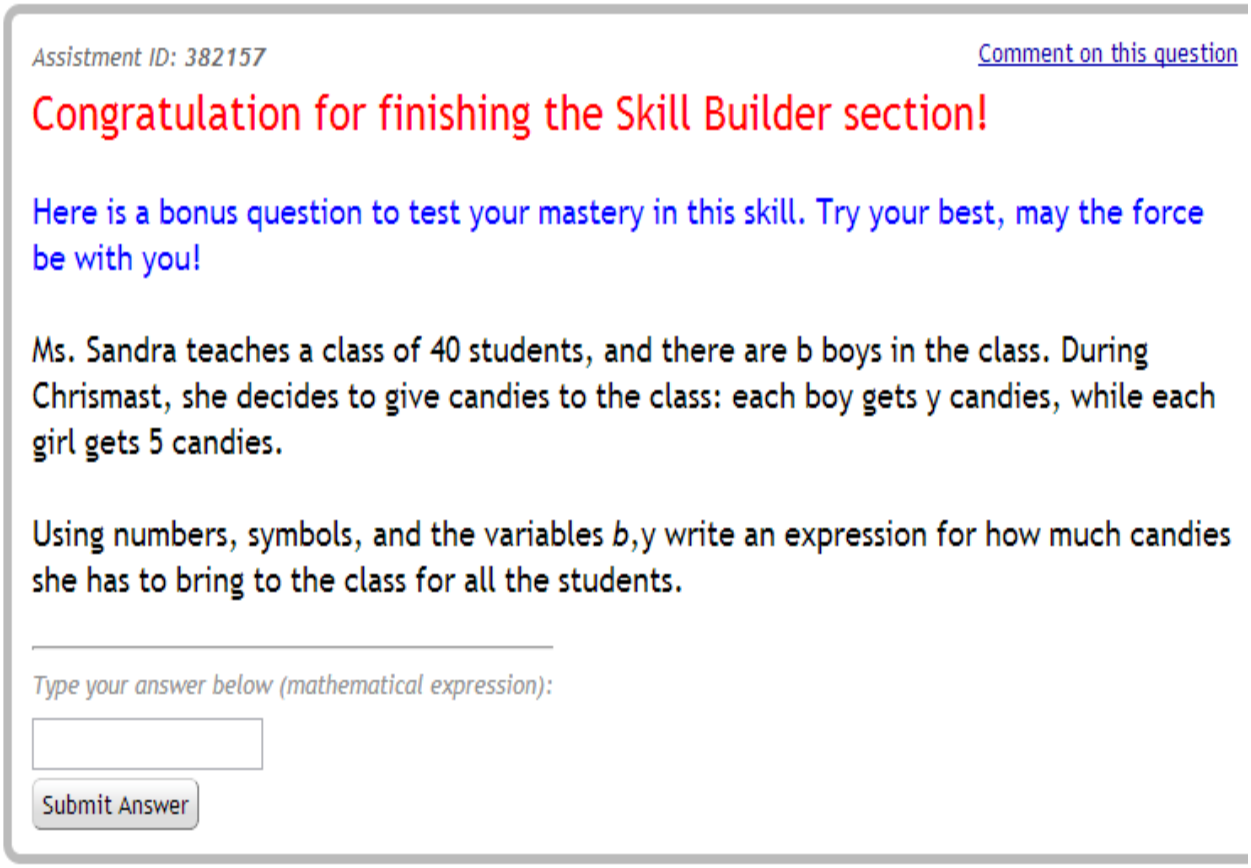


Figure 14: Far-transfer item (Skill 6.EE.B.6)

Now, we are ready to generate instantiated assistments from these templates in order to construct the required problem sets for our study. Since this process consumes a lot resource from the ASSISTments server and might interfere with the connections of other people to the website, we try to perform it during the low-traffic time of the day such as after midnight.

2.2. Problem Set Structure

We make all six problem sets to have the same structure for the convenience of organizing the study and analyzing the data. Figure 15 shows an example of this structure.

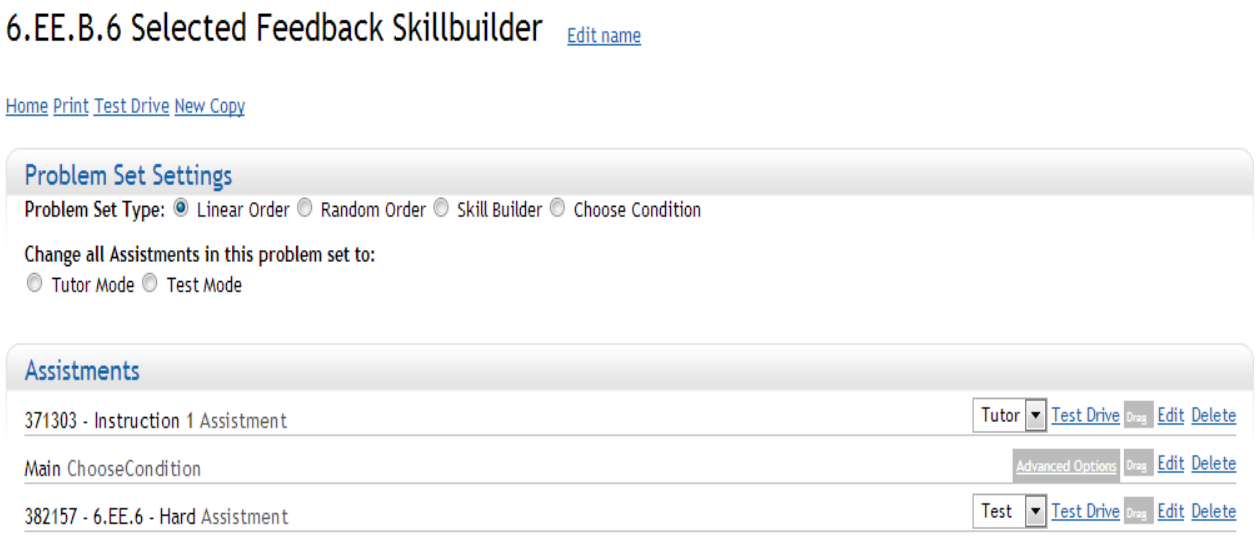


Figure 15: Problem Set Structure (Skill 6.EE.B.6)

All problem sets are linear order; each starts with an instruction assistment, which explaining the skill builder rule for the student, and ends with a far-transfer item, which testing the students' mastery on that skill in a higher level of difficulty. The main part is set in Choose Condition, which randomly assigned between two skill builders with identical content yet one with hints and one without hints. An example of the main part is shown below in Figure 16.

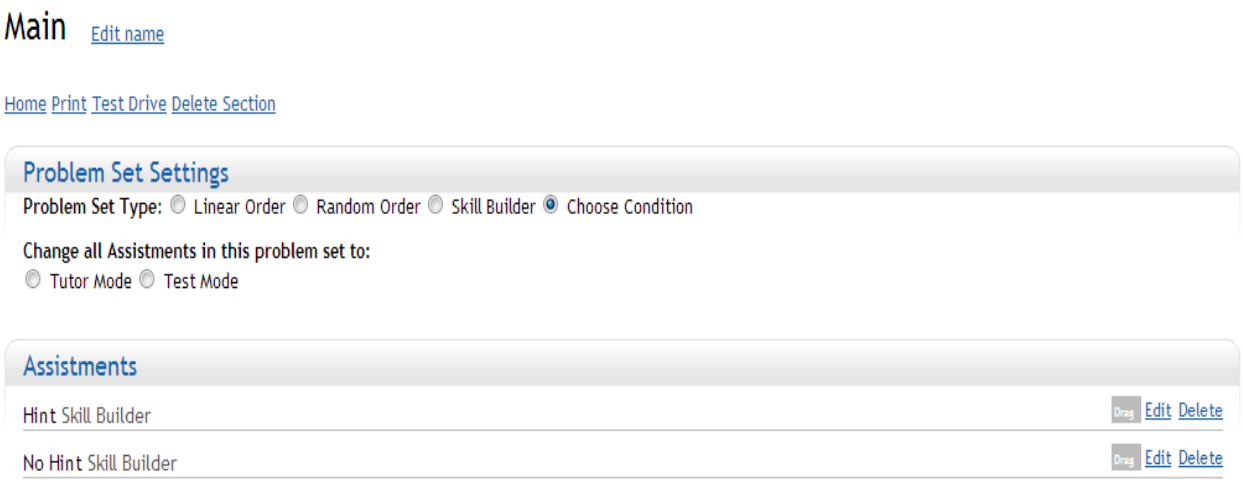


Figure 16: Main part of the problem set

From 10 to 15 instantiated assistments are generated from each template. Thus, each skill builder consists of from 100 to 150 different assistments of the same skill. To successfully complete a skill builder, a student has to answer correctly three problems in-a-row. A student can attempt up to a maximum of 20 problems a day.

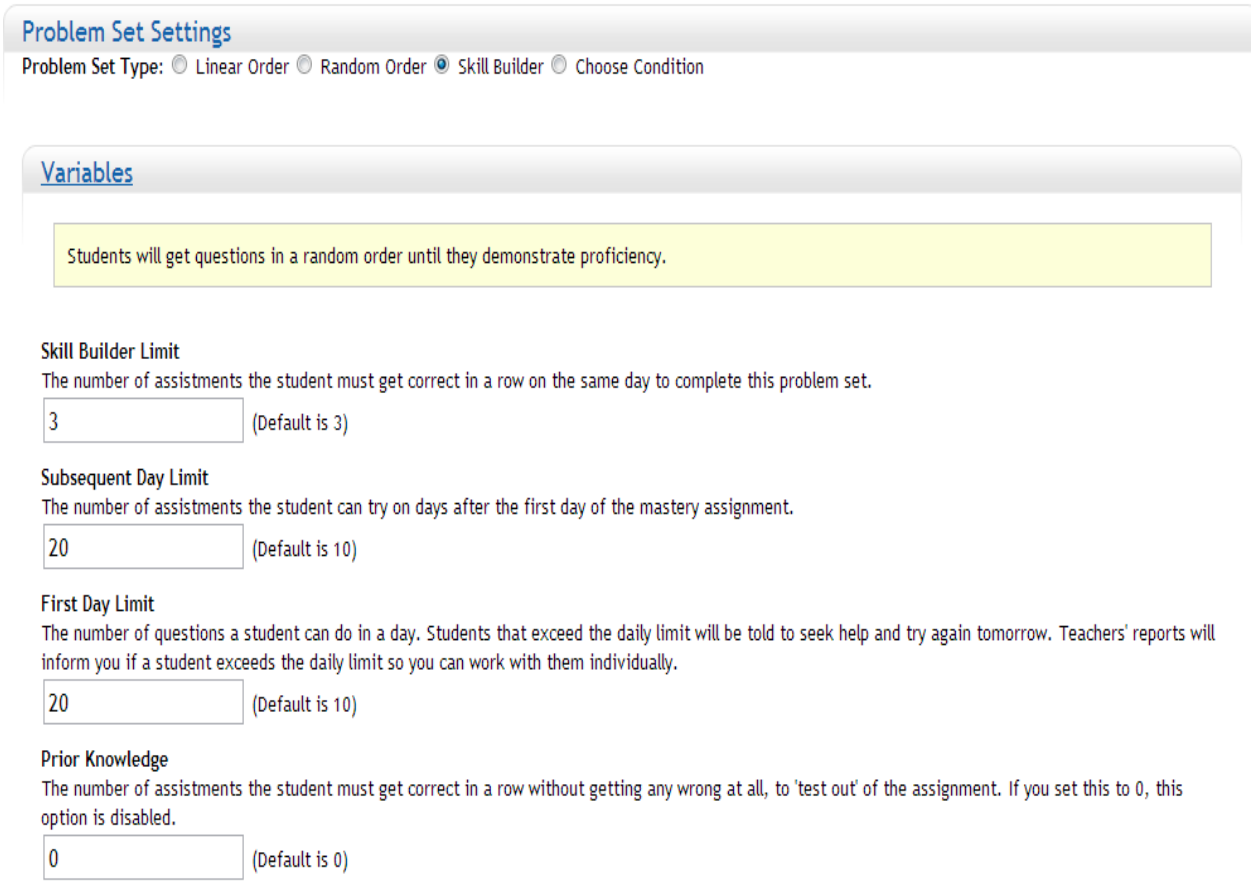


Figure 17: Skill Builder Settings

Finally, after the two terms, we successfully create the six problem sets targeting sixth graders. We test drive these entire problem sets before sending them to the public.

3. Study

In our study, due to the problem set settings, the students are randomly assigned to the skill builder with hints or without hints. At the beginning, they all receive the instruction on how they need

to get 3 right answers in-a-row in order to complete the skill builder. Finally, no matter they complete the skill builder with hint or without hint; they are exposed to the far-transfer item, which further evaluate their understanding on that skill.

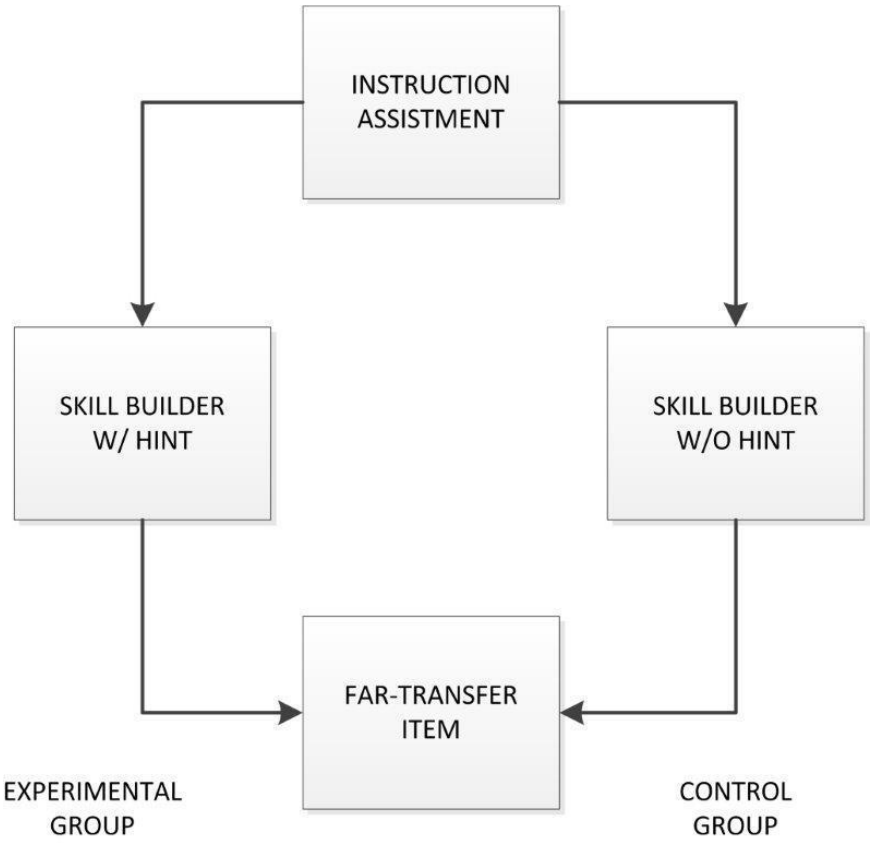


Figure 18: Study Set up

3.1. Hypothesis

Our hypothesis for this study is that detailed tutoring is more effective than only giving the right answer in helping a student master a specific mathematical skill. Thus, we will measure this difference through the analysis on the collected data. In order to achieve the result, the students are separated in two sections: the control group which receives only response feedback, and the experimental group which receives directive feedback through hints.

3.2. Experimental Environment

Our problem sets were given to several classes to be used by teachers who have agreed to incorporate them into their lesson plans. With this, we are able to obtain a variety of subjects, without focusing on only specific schools with specific curriculums. The teachers know about our experiment but the students participating in our study were unaware that they were participating in a study. When a teacher gives a student subject a specific skill set to master, the skill set assigned to the student will either be of the directive feedback condition or the response feedback condition at random. After one term, the data report is automatically collected through the ASSISTments system, thanks to Mr. Corey Belhumeur.

3.3. Data Collection

For our study, a large amount of raw data was obtained from the ASSISTments grade book system. This data was then transferred into an Excel spreadsheet where it was filtered and organized using pivot tables. Our problem sets are used by 4 different teachers in their classes. With a total of 234 students participating in the study, there are 5,761 problems recorded. For each problem, the following information is recorded:

- First name
- Last name
- Student ID
- Teacher ID
- Teacher Log in
- Student Class ID
- Sequence ID
- Problem Log ID

- Assistment ID
- Problem ID
- Correct
- First Action
- Hint Count
- Answer ID
- Answer Text
- Bottom Hint
- Attempt Count
- Start Time
- End Time
- First Response Time

	A	B	C	D	E	F	G	H	I	J	K	
1	first_nam	last_nam	student_	teacher_i	teacher_login	student	sequence	problem_lo	assistmen	problem_	correct	firs
2	[redacted]						82813	141703167	374489	602691	0	
3	[redacted]						82813	141703176	374511	602713	0	
4	[redacted]						82813	141703185	374500	602702	0	
5	[redacted]						82699	141703397	371303	598175	1	
6	[redacted]						82813	141703190	374501	602703	0	
7	[redacted]						82813	141703198	374480	602682	1	
8	[redacted]						82813	141703199	374451	602653	0	
9	[redacted]						82813	141703218	374470	602672	1	

Figure 19: Raw Data of the Experiment

From ASSISTments system, we can obtain the record of each student's performance on all of the problem sets they have done. These records will serve as an indicator to separate students with higher mathematical skills from other students in each class. The data is translated into another Excel file with the following information:

- Student Name
- Total Problems
- Total Correct
- Correct Percentage
- Total Hint

	A	B	C	D	E
1		Total Done	Total Correct	Percent correct	Total hints
2	[redacted]	443	288	65%	230
3	[redacted]	980	637	65%	358
4	[redacted]	93	41	44%	21
5	[redacted]	1581	1341	84%	199

Figure 20: Raw Data of Student Performance

3.4. Assumptions

The first assumption is that in each skill builder, the difficulty levels of individual problems within each skill set are approximately equal. Therefore, the control group and the experimental group are exposed to the same level of difficulty and the difference in their performance is a reliable indicator for the effectiveness of hints.

The second assumption is that the student records in each class are fairly accurate. As later, we will use these records as the indicator to separate between the class percentiles in order to see the effect of hints on different student groups.

3.5. Processing the Data

3.5.1. Removing unnecessary columns

The first step is to determine what data is necessary and can be used as well as what data is not. The student ID is unique, and can represent the student's first name, last name, the teacher ID, the teacher log in, and the student class ID. Thus, out of the first six columns, only the student ID matters, and will be used to identify the students. The Sequence ID is used to separate between different skills. Problem Log ID is a good indicator for the time the problem is started and will be used to sort all the problems a student have done in the order of their occurrence. The Assistment ID is used to identify the type of assistments, including the instruction one, the far-transfer items, the ones with hint, and the ones without hints. The three most important columns are Correct, Hint Count, and Bottom Hint, which are essential for our analysis on the effectiveness of the two methods. The other columns are not necessary, and will be keep in archived.

3.5.2. Separate the data

Based on the Sequence ID, we separate the original data into 6 different Excel sheets, each for one skill.

Table 2: Six skills and their sequence ID

Skill	Sequence ID
6.EE.A.2a	85113
6.EE.A.2c	85588
6.EE.A.4	85161
6.EE.B.5	82812
6.EE.B.6	82699

6.EE.B.8	82813

Next, based on the Assistment ID, we are also able to separate between the problems with hints and without hints in each skill. Since the instruction assistment doesn't play any role in our study, we eliminate them from all the sheets. All the far-transfer items are moved to another Excel sheet in order to easily perform additional analysis on them. Therefore, we create in total 13 new Excel sheets: 2 sheets for each skill, and 1 sheet for the far-transfer items.

3.5.3. Counting the data

Every sheets are sorted first by the Student ID, then the Problem log ID so all the problems a student has done will appear in the order of occurrence. If the last three problems are correct, it means the student successfully complete the skill builder. Otherwise, the student is not able to finish it. The Hint Count and Bottom Hint Count for each student are just the sum of all the problems he or she did. We also want to count how many problems a student has to go through before completing the skill builder. Moreover, we also need to see whether students are able to complete the far-transfer items in each skill. This process will be very tedious and time-consuming; thus, we create a MATLAB script to automatically perform the counting process for us. The detail implementation could be found in the Appendix.

The counting process takes less than 5 minutes, and the result is summary in an Excel sheet as shown below. The Hint Condition, Problem Count, Complete, Hint Count, Bottom Hint Count, and the Transfer items are recorded for every student in each skill.

	A	B	C	D	E	F	G	H	I	J
1	first_nam	last_nam	student_	teacher_I	85588_Condition	85588_Count	85588_Complete	85588_HintCount	85588_BottomHint	85588_Transfer
2	[redacted]				0	3	1	0	0	NaN
3	[redacted]				1	3	1	0	0	1
4	[redacted]				1	3	1	0	0	0
5	[redacted]				NaN	NaN	NaN	NaN	NaN	NaN
6	[redacted]				0	4	1	1	1	1
7	[redacted]				0	3	1	0	0	0
8	[redacted]				NaN	NaN	NaN	NaN	NaN	NaN
9	[redacted]				1	3	1	0	0	0

Figure 21: Processed Data for each skill

With this summarized data sheet, we can now perform statistical analysis to determine the outcome of our study on whether interactive feedback or knowledge of response feedback is better in term of helping the students to master a specific skill.

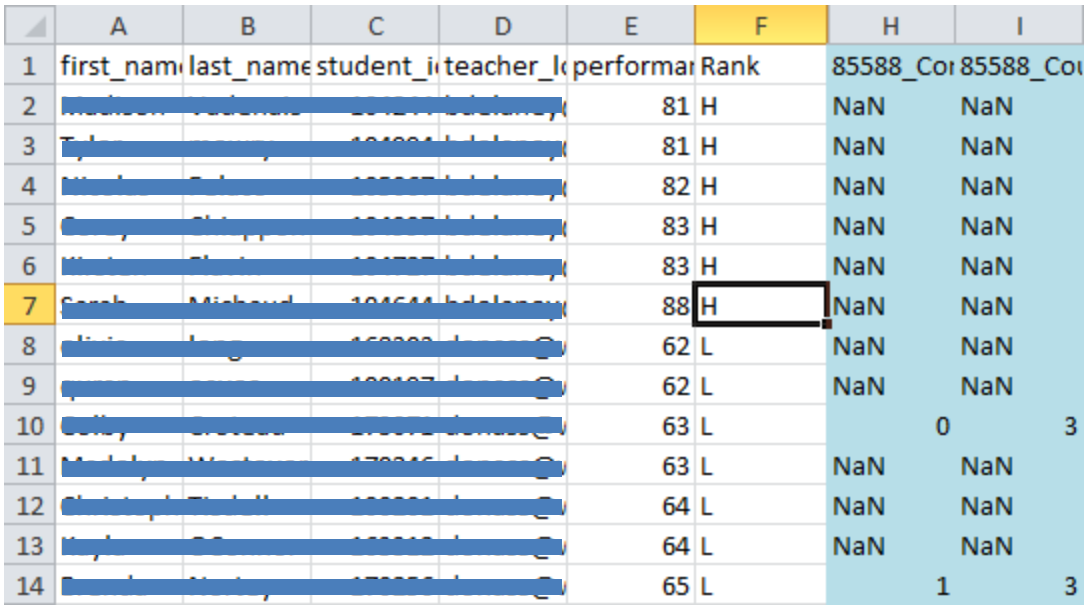
3.6. Classify the Students

For each class, the students are sorted based on their percentage of correct answers from all the assistment that they have done. The underperformed students are indicated in brown, the average performing students are marked yellow and the well performed ones are in blue. This ranking is based solely upon their performance in assistment.

	A	B	C	D	E
1		Total Done	Total Correct	Percent correct	Total hints
2	[redacted]	320	62	19%	213
3	[redacted]	629	164	26%	492
4	[redacted]	77	26	33%	25
6	[redacted]	560	220	39%	216
7	[redacted]	74	31	41%	22
17	[redacted]	492	243	49%	214
76	[redacted]	676	527	77%	66
77	[redacted]	661	510	77%	74
78	[redacted]	678	532	78%	73

Figure 22: Sorted Student Performance in each class

We then constructed another column to implement this ranking into our assistment data. The well performed students are ranked H while the others are ranked L. Using this rank, the student is later sorted into two groups: Good and Normal. Hence further analysis can be made on the result based on the performance of student.



	A	B	C	D	E	F	H	I
1	first_nam	last_name	student_i	teacher_l	performar	Rank	85588_Cor	85588_Cou
2	[redacted]				81	H	NaN	NaN
3	[redacted]				81	H	NaN	NaN
4	[redacted]				82	H	NaN	NaN
5	[redacted]				83	H	NaN	NaN
6	[redacted]				83	H	NaN	NaN
7	[redacted]				88	H	NaN	NaN
8	[redacted]				62	L	NaN	NaN
9	[redacted]				62	L	NaN	NaN
10	[redacted]				63	L	0	3
11	[redacted]				63	L	NaN	NaN
12	[redacted]				64	L	NaN	NaN
13	[redacted]				64	L	NaN	NaN
14	[redacted]				65	L	1	3

Figure 23: Classify all the Students

4. Results

In this section, we perform several statistical tests on the processed data in order to prove our hypothesis. The six skills are separated into two groups based on their difficulty level, Hard and Easy, while the students are also classified into two groups based on their performances, Normal and Good. Further analysis is employed to see the variant of the effects of directive feedback on different student groups on different skill types.

4.1. Overall Distribution

Table 3: Student Distribution in each skill

Sequence ID	Total Students	With Hints	Without hints
85588	84	44	40
85161	91	53	38

82699	150	77	73
85113	163	83	80
82812	87	42	45
82813	118	62	56

The overall distribution of problems done by students is varied. A skill set can be assigned to a class by the teacher. Students in the same class will have the same skill sets assigned to them. However there is no specific requirement of which skill sets to be chosen by the teacher. In other words, skill sets are given at the teacher's will. As we can see from the above table, there is no specific pattern in the number of students in each problem set. However, the table does reflect the random assignment of the directive feedback condition and response feedback condition. The number of students in each condition is not significantly different.

4.2. Overall Completion Rate

Table 4: Overall Completion Rate

Sequence	85588	85161	82699	85113	82812	82813
Completion Rate (Hint)	0.818	0.887	0.896	0.867	0.571	0.548
Completion Rate (No Hint)	0.75	0.842	0.877	0.288	0.60	0.429
T-test	0.453	0.540	0.710	1.55E-16	0.790	0.197
Effect Size	0.155	0.121	0.059	1.273	0.058	0.240
Chi-Squared Test	0.901	0.943	0.987	3.53E-12	0.995	0.639

At first glance, looking at the completion rate of both Hint and No Hint groups, the result does not support our hypothesis. For the majority of the skills, students did well regardless of their problem set's condition. However, we saw two odd results. In problem set 85113 and 82813, the completion rates of the No Hint group are less than half i.e. only 28.8% and 42.9% for sequence 85113 and 82813 respectively. Hence we classified the 2 skill sets as harder skill sets. This classification will allow us to perform further analysis on the results based on the difficulty of the skill. Thus, we separate the six skills into two groups:

- 4 easy skills: 85588, 85161, 82699, and 82812
- 2 hard skills: 85113 (very hard) and 82813 (moderately hard)

Focusing on the completion rates recorded for both cases of with hint and without hints, we could see that the completion rates of problem set with hints are higher than the ones without hints for five of out of the six skills. In the hard skill i.e. sequences 85113 and 82813, the differences are more transparent especially in sequence 85113.

Next, we computed the t-test to see how large these differences are. As seen, sequence 85113 has amazingly low value compared to the much higher values of the four easy skills. Sequence 82813 have relatively small t-test values but it's still quite high ($p>0.05$) to draw any conclusion from that.

In the next step, we computed the effect sizes of the six sequences. The effect size of sequence 85113 is exceptionally high, as expected of a very hard skill. The r-value is much greater than 0.5, which indicates that the effect of the Hint/No Hint condition accounts largely for the difference between the completions rates of the Hint versus the No Hint group. The r-value of the remaining skills is quite low. Sequence 82813 have a higher value than others ($r = 0.240$) but since $r < 0.3$, again we cannot draw any conclusion for this skill set.

We decided to push the analysis further by computing the chi-squared test for each of the sequence. Looking at the results of the chi-squared test, the four easy skill sets have very high p-value while sequence 85113 once again has extremely low value. Hence, combining all the analysis so far, we can say that this very hard skill set supports the hypothesis that the condition Hint/No Hint has an impact upon the student performance in doing assistment. The four easy skill sets show no sign of supporting our hypothesis. Sequence 82813, for this test, have quite high value but not as high as the four easy skill sets once again. Thus, for all tests, the test values for this moderately hard problem set are always on the verge of either supporting or negating the hypothesis. This indicates that even though it does not support our hypothesis yet, it does not absolutely reject the hypothesis either.

Therefore, we tried to clean up the data a little bit more by the process of disqualification. The students who completed the skill set by getting three problems right in a row are eliminated as they did not use any hints. And surprisingly with this process, we get a more interesting result for sequence 82813 as follow.

Table 5: Overall Completion Rate (After Disqualification)

Sequence	85588	85161	82699	85113	85812	82813
Completion Rate (Hint)	0.680	0.778	0.864	0.831	0.526	0.541
Completion Rate (No Hint)	0.600	0.727	0.813	0.081	0.419	0.373
T-test	0.565	0.690	0.470	2.324E-24	0.384	**0.076**
Effect Size	0.160	0.111	0.132	2.732	0.213	**0.345**
Chi-squared Test	0.951	0.983	0.911	1.773E-15	0.854	**0.346**

As we can see, while the results for the first five skill sets didn't change the conclusion that we have made about them so far we got quite interesting results for sequence 82813. The p-value of the T-test has come really close to the critical value 0.05. The effect size r-value is now greater than 0.3, which indicates that the condition has medium effect on the completion rate. The p-value of chi-squared test is now lower than 0.352, which is the critical value of the chi-squared test with three as degree of freedom and default significance level (0.05). Henceforth, we add another conclusion that for a moderately hard problem sets, the condition indeed has an effect on the performance of the student.

4.3. Far-transfer Items

Table 6: Far-transfer items completion rate

Sequence	85588	85161	82699	85113	82812	82813
Transfer Items Completion Rate (Hint)	0.44	0.81	0.072	0.069	0.33	0.029
Transfer Items Completion Rate (No Hint)	0.40	0.88	0.16	0.043	0.59	0.083

The table above describes our initial far-transfer item analysis. This is to see if the experimental condition of a skill set has any effect on the probability of completion of the far-transfer item specific to the skill set. The table figures above draws conflicting information on the effect of the experimental condition. So we went a step further and redo our analysis based on the skill set's difficulty. We obtain the following table.

Table 7: Far-transfer item completion rate for the Hard and Easy skills

Skill Set	Hard	Easy
Average Transfer Item Completion Rate (Hint)	0.051	0.35

Average Transfer Item Completion Rate (No Hint)	0.038	0.15
T-test of Completion Rate	0.75	7.96E-4

From this table, we can see that the experimental condition yield no significant effect on the hard skill sets. While as for the easy skill sets, the t-test reflect a significant difference in the transfer item completion rate between the 2 conditions. We can see that the transfer item completion rate for the experimental condition is significantly higher than that of the control condition. This support our hypothesis that the experimental condition has positive impacts on helping students master an easy skill set while yielding almost no impact on helping student with a hard skill set.

4.4. Selective Completion Rate

In order to see the effect of directive feedback or hints on the two different groups of students, Normal and Good, we compute the selective completion rates for both the easy skills and hard skills. The result is shown below.

Table 8: Selective Completion Rate

Difficulty		Easy Skill		Hard Skill	
Condition		Hint	No Hint	Hint	No Hint
Average Completion Rate	Normal	0.686	0.704	0.585	0.182
	Good	0.905	0.813	0.828	0.412
T-test	Normal	0.810		2.198E-06	
	Good	0.092		0.048	

As seen, for both the normal and good students, directive feedback or giving hints improves the completion rate of the students. Next, we calculated the t-test value in order to see how much of the differences. For the easy skills, there is not much difference for the normal student group while there is moderate difference for the good student group. For the hard skills, there is still moderate difference for the good student group, while there is a huge difference for the normal group.

These phenomena are understandable since the well-performed students are able to quickly figure out how to complete the skill builders, giving them detail hints doesn't bring much of the improvement. However, the underperformed students are having difficult time with the hard skills, and directive feedback could help them understand these problems quicker and guide them through these skill builders.

5. Conclusion

Our data strongly support the validity of our hypothesis. Overall, student subjects generally perform better when exposed to the directive feedback condition than the response feedback condition in terms of completion rate as well as far transfer item completion. The effect is even clearer for the very hard and moderately hard skills.

Our in depth analysis took into consideration the difficulty level of the skill set itself as well as the level of mathematical skill of the student participating in the study. It appears that the harder the skills, the more effective the hints bring to the students. Moreover, there is not much improvement for the well-performed students, but huge improvement for the underperformed ones.

However there are various parameters that were ignored in the analysis such as bias in the data. For instance, when students click on hints without inputting answer, it is considered wrong but the system doesn't warn students about the scoring system which might bias data. Another constraint we

had in our study was time, only 7 weeks to send out the problem sets to the teachers. If we could have got more students participating in our study, our conclusions would be more authentic due to the large statistical number.

Moreover, the experimental environment under which our study was conducted was not perfect. Although we want the students to work on the problem sets independently, they might seek for assistance from peers and teachers, which brings bias to the data. Also, there might not be enough incentive for the students to be interested in the ASSISTments system, and they didn't bring out their best performance when doing the skill builder.

In conclusion, our experimental data could have been biased on either side and assuming the equal possibility of both favorable and unfavorable cases, we can safely overlook the effect of bias in data. This leads to a very concrete conclusion that the direct feedback through hints is more effective than just the knowledge of response feedback about whether the answer is right or wrong.

References

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http://www.assistments.org/staticpages/AboutUs.htm

The ASSISTments Teacher Wiki:

http://teacherwiki.assistment.org/

The Common Core Standards:

http://www.corestandards.org/Math/Content/6/EE

Effect Size Guide

http://www.statisticshell.com/docs/effectsizes.pdf

Chi-squared Critical Value

http://www.itl.nist.gov/div898/handbook/eda/section3/eda3674.htm#LOWERCV

Appendix A - Template Description

Skill	Class
Write Expressions	6.EE.2a

Mastery Problem Set	Number of Templates
69008	12
Number to Master	**Number of Attempts**
3 in-a-row	

Templates

340269

- The given numbers is between 5 and 20
- Expression: subtraction
- One variable
- Answer type: Fill in

340270

- The given numbers is between 5 and 20
- Expression: addition
- One variable
- Answer type: Fill in

340271

- The given numbers is between 5 and 20
- Expression: division
- One variable
- Answer type: Fill in

340272

- The given numbers is between 5 and 20
- Expression: multiplication
- One variable
- Answer type: Fill in

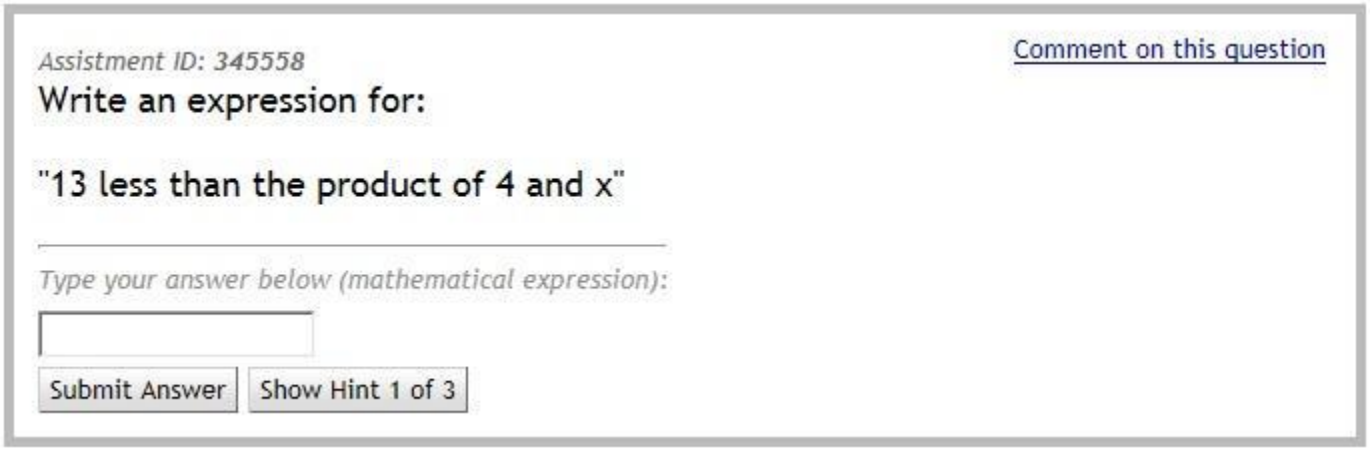
345530

- The given numbers are between 5 and 20, and between 2 and 7
- Expression: addition and multiplication
- One variable
- Answer type: Fill in

345541

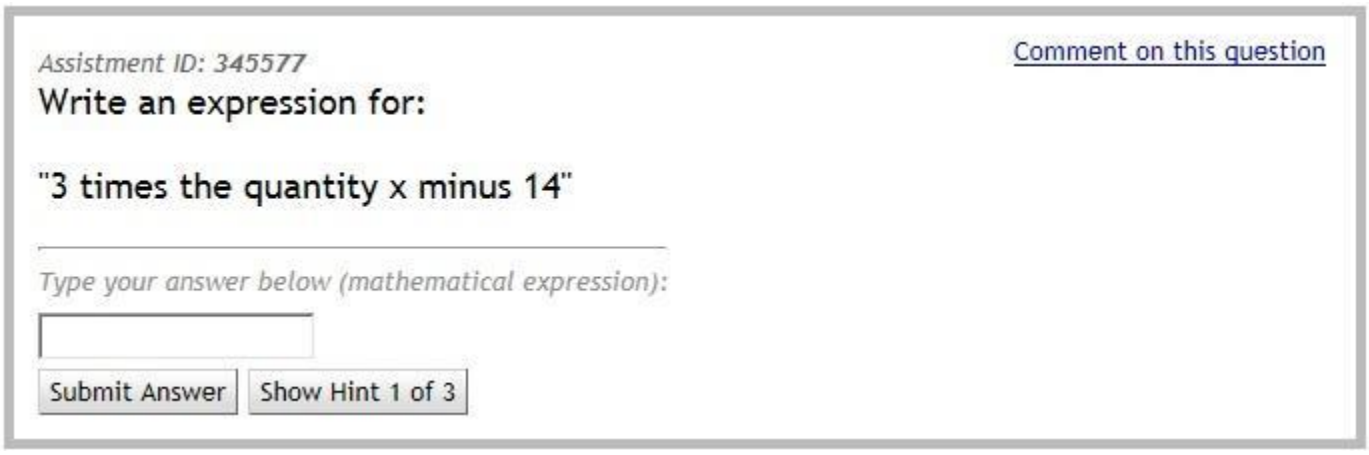
- The given numbers is between 5 and 20, and between 2 and 7
- Expression: addition and multiplication
- One variable
- Answer type: Fill in

345558



- The given numbers is between 5 and 20, and between 2 and 7
- Expression: subtraction and multiplication
- One variable
- Answer type: Fill in

345577

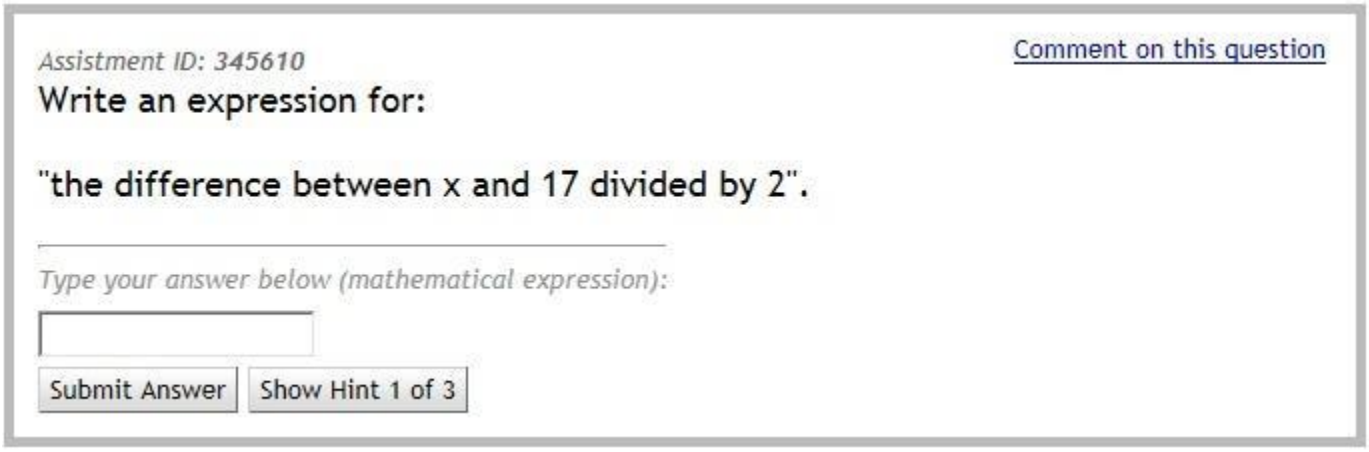


- The given numbers is between 5 and 20, and between 2 and 7
- Expression: subtraction and multiplication
- One variable
- Answer type: Fill in

345604

- The given numbers is between 5 and 20, and between 2 and 7
- Expression: addition and division
- One variable
- Answer type: Fill in

345610



- The given numbers is between 5 and 20, and between 2 and 7
- Expression: subtraction and division
- One variable
- Answer type: Fill in

Skill	Class
Identify Equivalent Expressions	6.EE.2c

Mastery Problem Set	Number of Templates
	10
Number to Master	Number of Attempts
3 in-a-row	

Templates

341324

Assistment ID: 341324 Comment on this question

Let s be the length of a square's side.

Given s equal 2
What is the volume of the square?

The formula of volume of a square is:
$V = s^3$

Type your answer below:

Submit Answer | Show Hint 1 of 2

- The given numbers is between 2 and 8
- Expression: multiplication
- One variable
- Answer type: Fill in

341326

Assistment ID: 341326 Comment on this question

Let s be the length of a square's side

Given s equal 5
What is the surface area of the square?

The formula of surface area of a square is:
$A = 6s^2$

Type your answer below:

Submit Answer | Show Hint 1 of 2

- The given numbers is between 2 and 8
- Expression: multiplication
- One variable
- Answer type: Fill in

341327

- The given numbers is between 2 and 8
- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Fill in

343238

- The given numbers is between 2 and 8
- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Fill in

343239

- The given numbers is between 2 and 8
- Expression: multiplication
- One variable
- Answer type: Fill in

346645

- The given numbers is between 2 and 8
- Expression: multiplication
- One variable
- Answer type: Fill in

346646

- The given numbers is between 2 and 8
- Expression: addition, division and multiplication
- One variable
- Answer type: Fill in

346652

- The given numbers is between 2 and 8
- Expression: division, subtraction and multiplication
- One variable
- Answer type: Fill in

346653

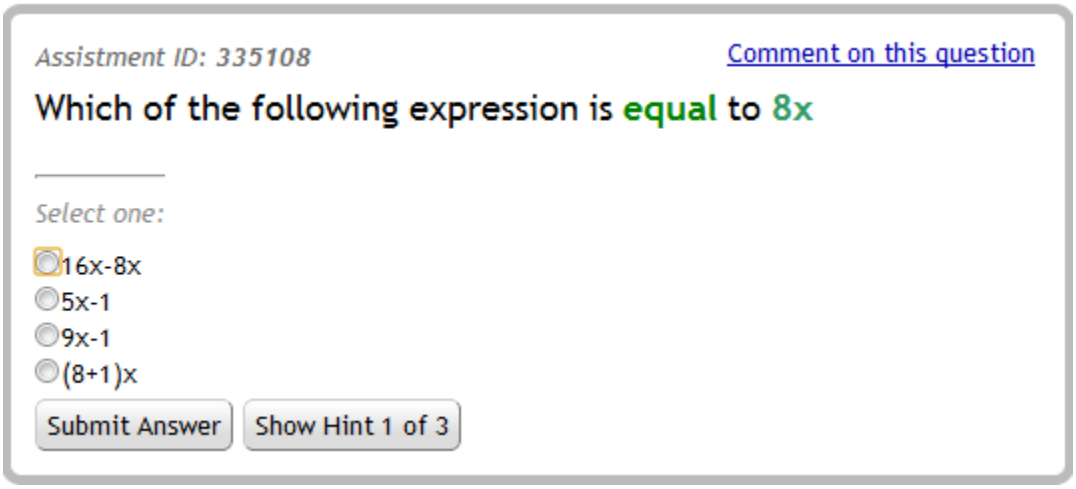
- The given numbers is between 2 and 8
- Expression: division, subtraction and multiplication
- One variable
- Answer type: Fill in

Skill	Class
Identify Equivalent Expressions	6.EE.4

Mastery Problem Set	Number of Templates
	9
Number to Master	**Number of Attempts**
3 in-a-row	

Templates

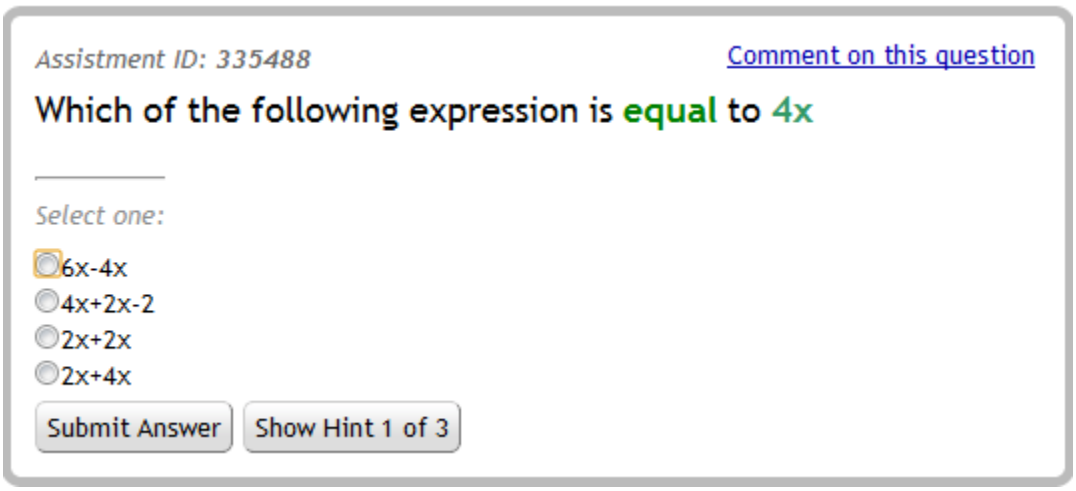
335108



- The given numbers is between 1 and 16
- Expression: addition, subtraction and multiplication

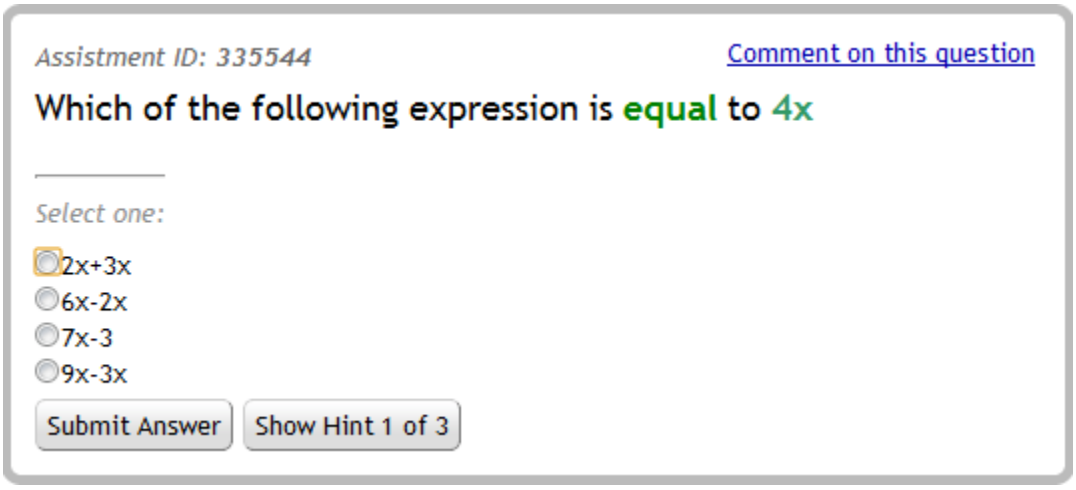
- One variable
- Answer type: Multiple Choices

335488



- The given numbers is between 1 and 10
- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Multiple Choices

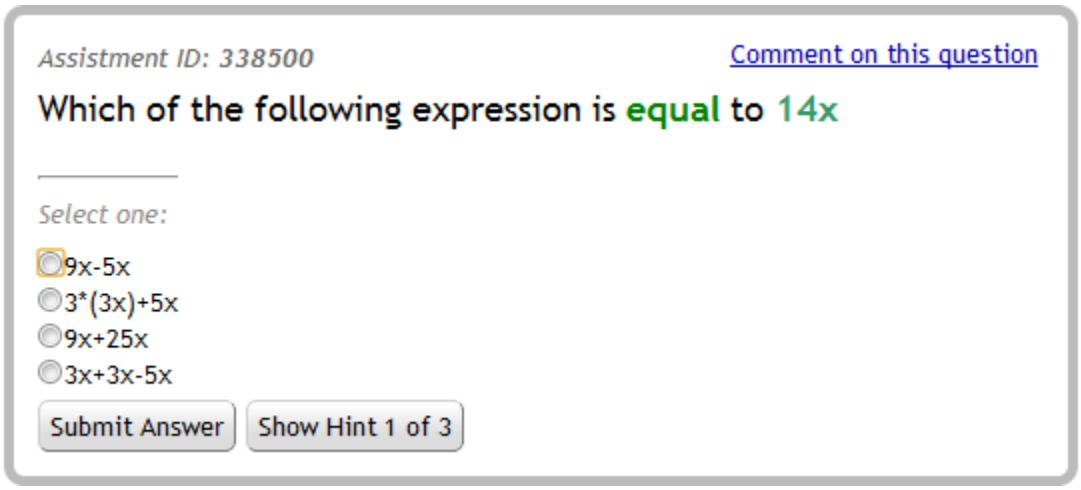
335544



- The given numbers is between 1 and 10

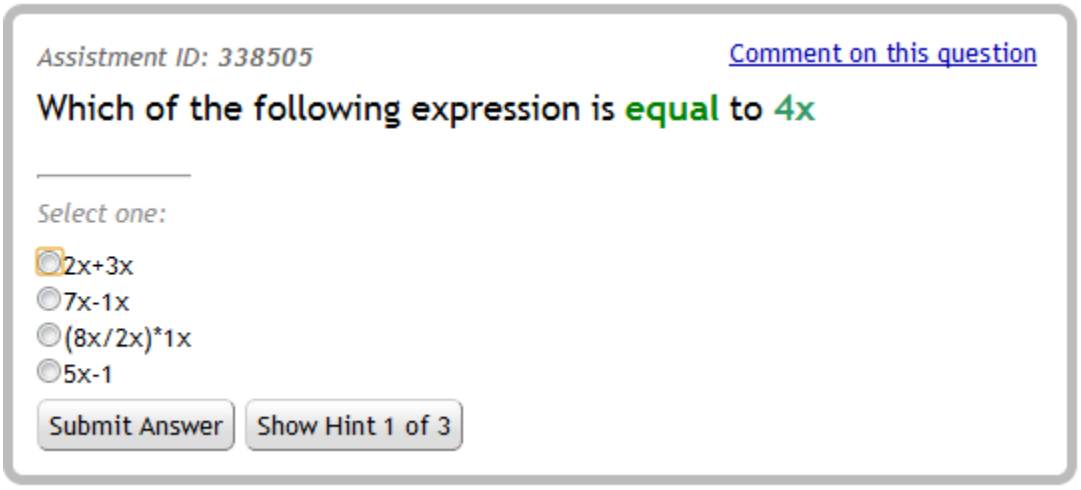
- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Multiple Choices

338500



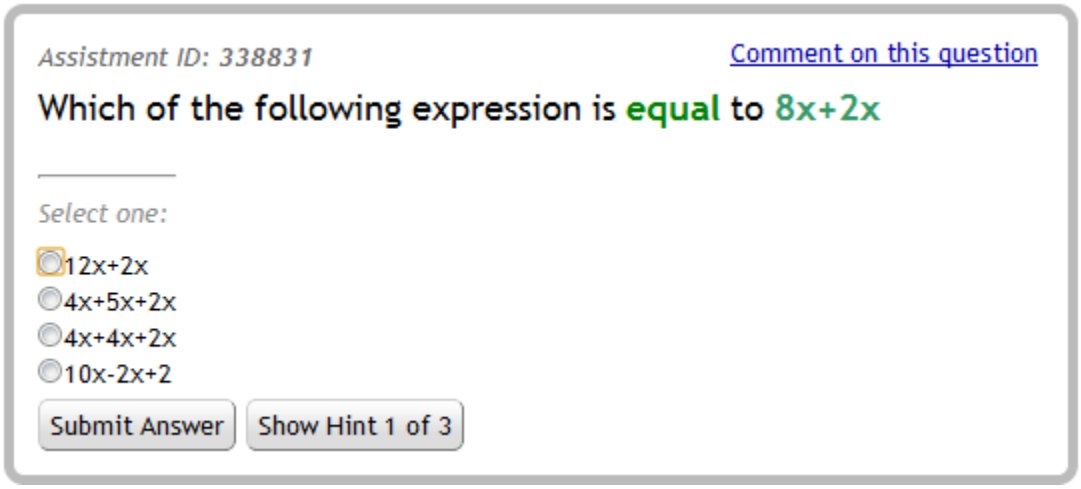
- The given numbers is between 2 and 64
- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Multiple Choices

338505



- The given numbers is between 1 and 15
- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Multiple Choices

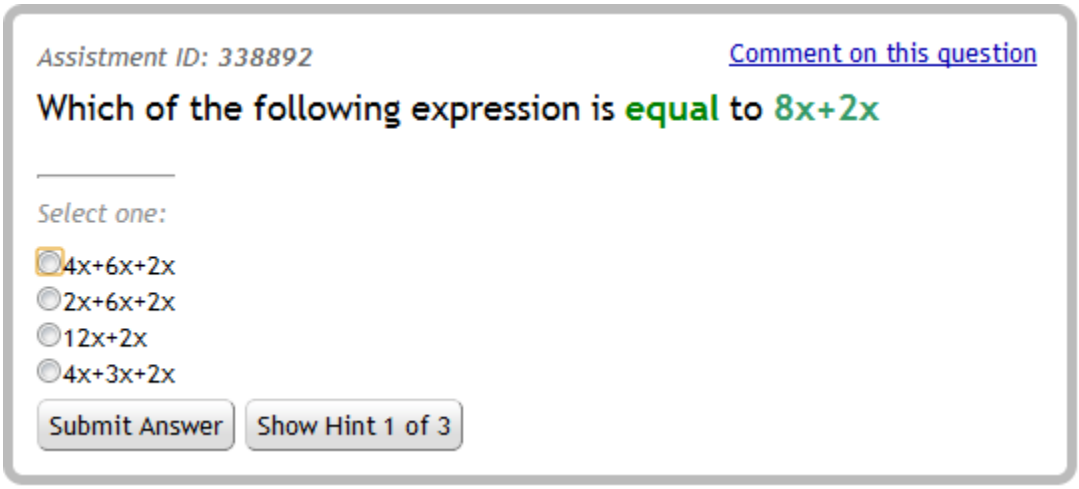
338831



- The given numbers is between 1 and 15
- Expression: addition, subtraction and multiplication
- One variable

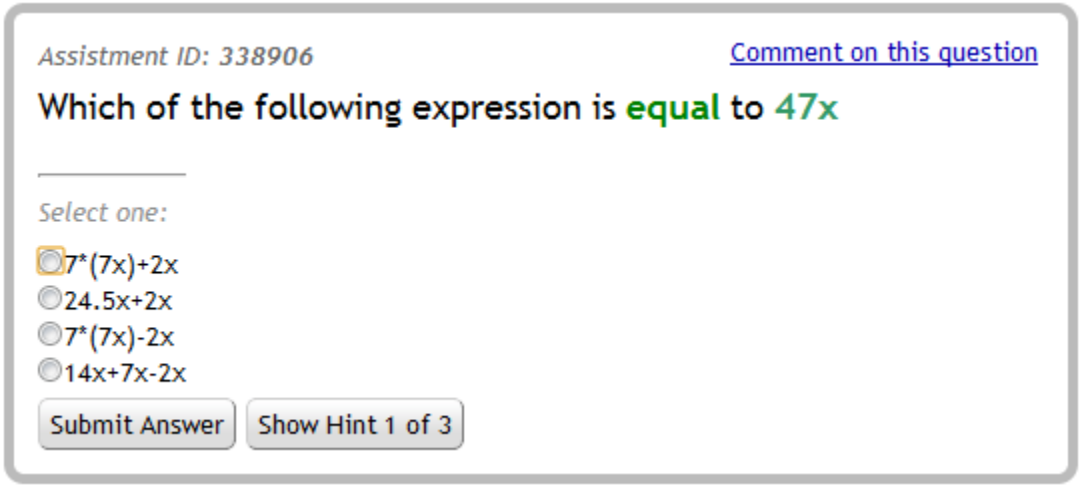
- Answer type: Multiple Choices

338892



- The given numbers is between 1 and 15
- Expression: addition and multiplication
- One variable
- Answer type: Multiple Choices

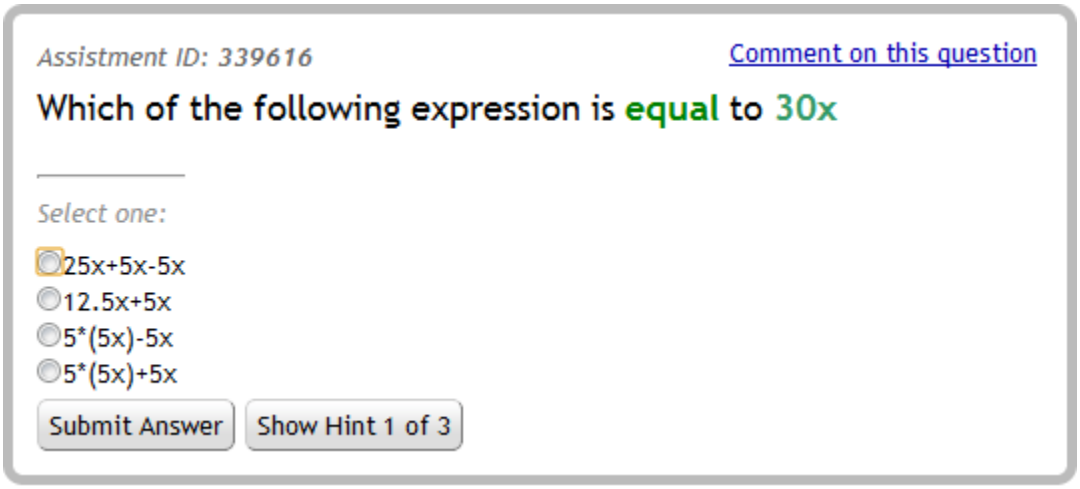
338906



- The given numbers is between 2 and 64

- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Multiple Choices

339616



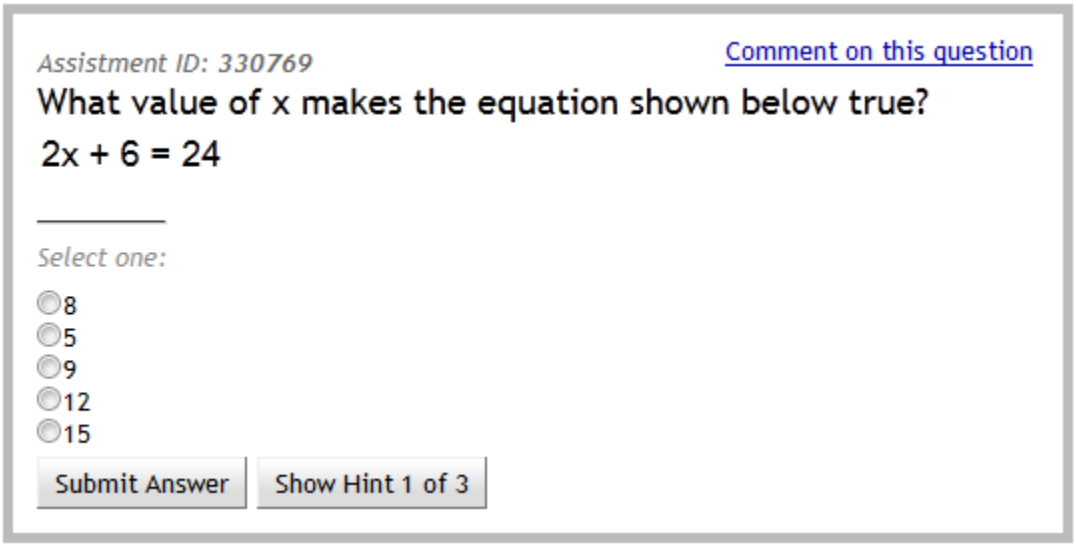
- The given numbers is between 2 and 64
- Expression: addition, subtraction and multiplication
- One variable
- Answer type: Multiple Choices

Skill	Class
Solving an equation or inequality using substitution	6.EE.5

Mastery Problem Set	Number of Templates
72453	18
Number to Master	**Number of Attempts**
5 in-a-row	

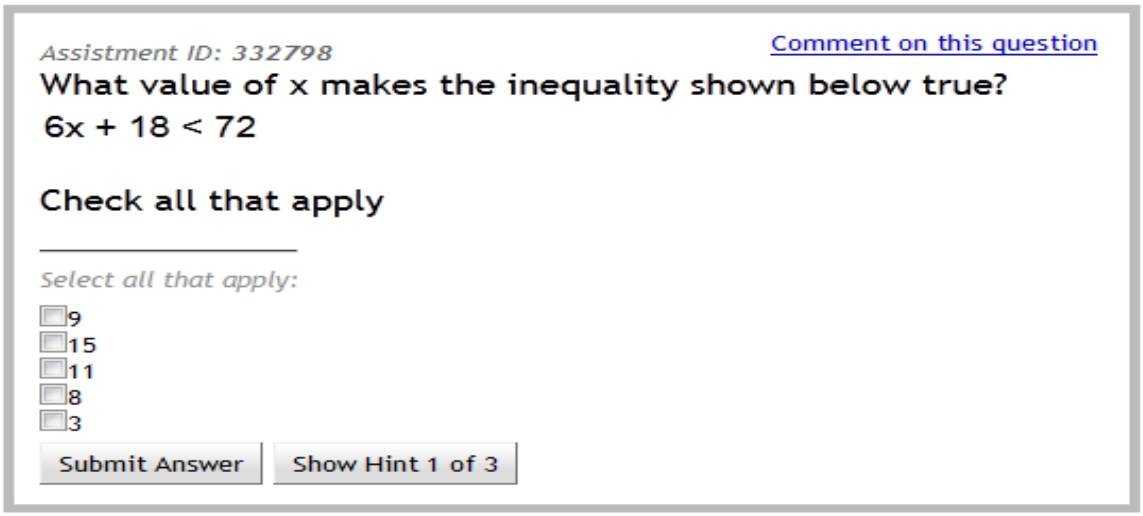
Templates

330769



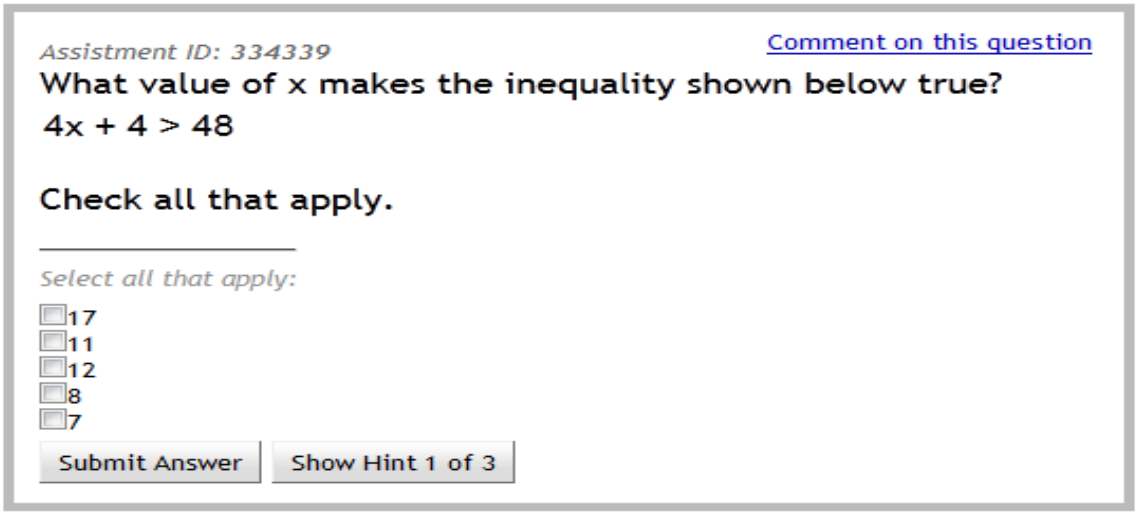
- The answers are between 1 and 25.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

332798



- The answers are between 1 and 25.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

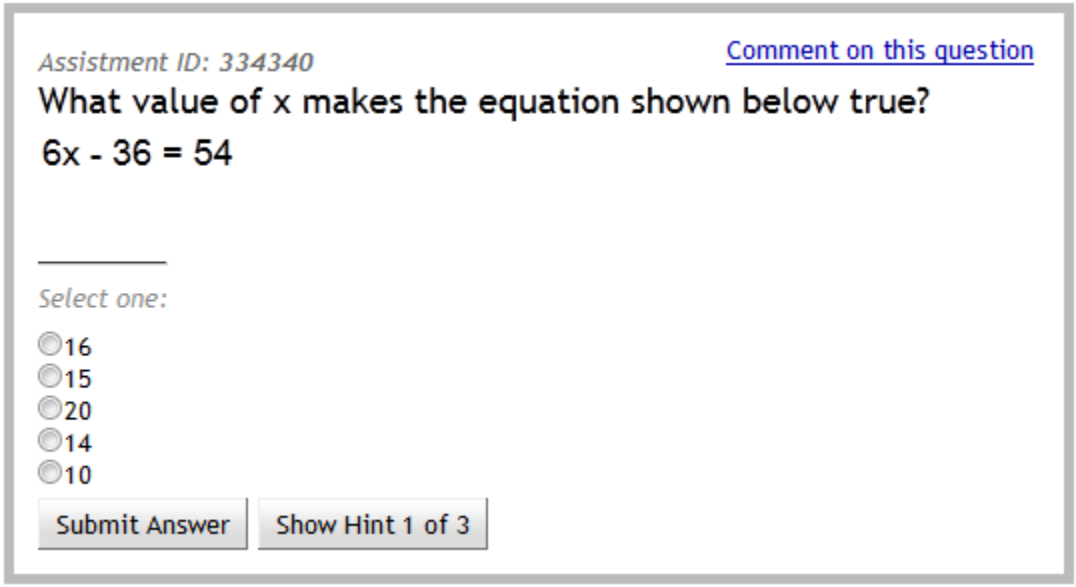
334339



- The answers are between 1 and 25.

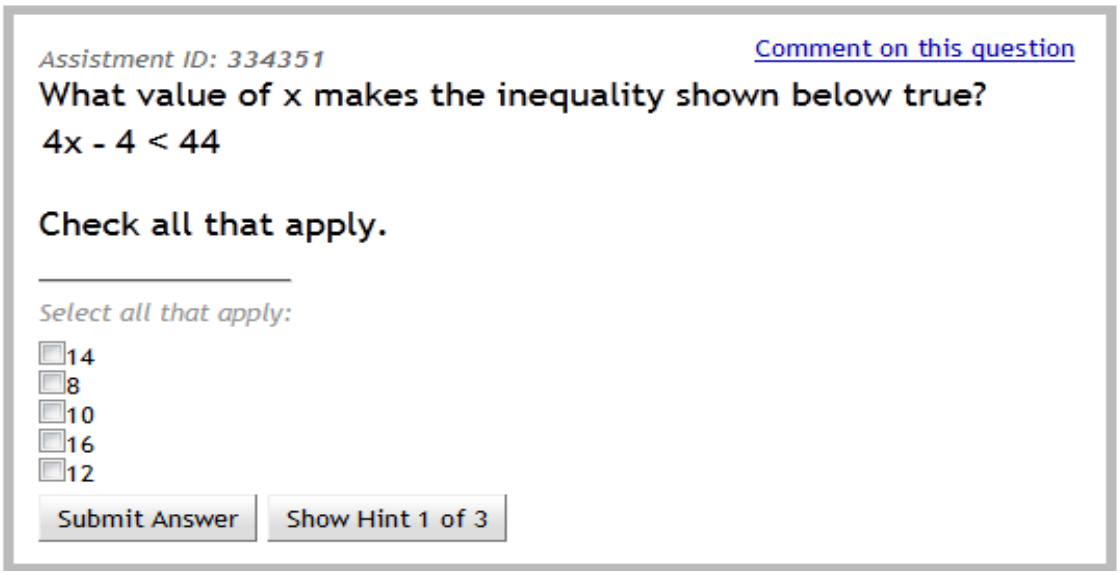
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

334340



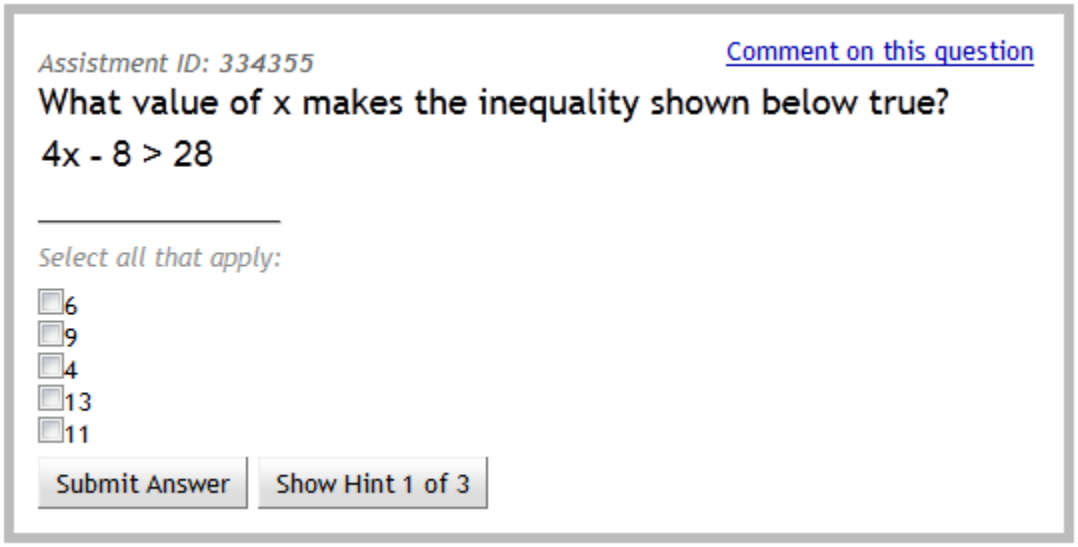
- The answers are between 1 and 30.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

334351



- The answers are between 1 and 30.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

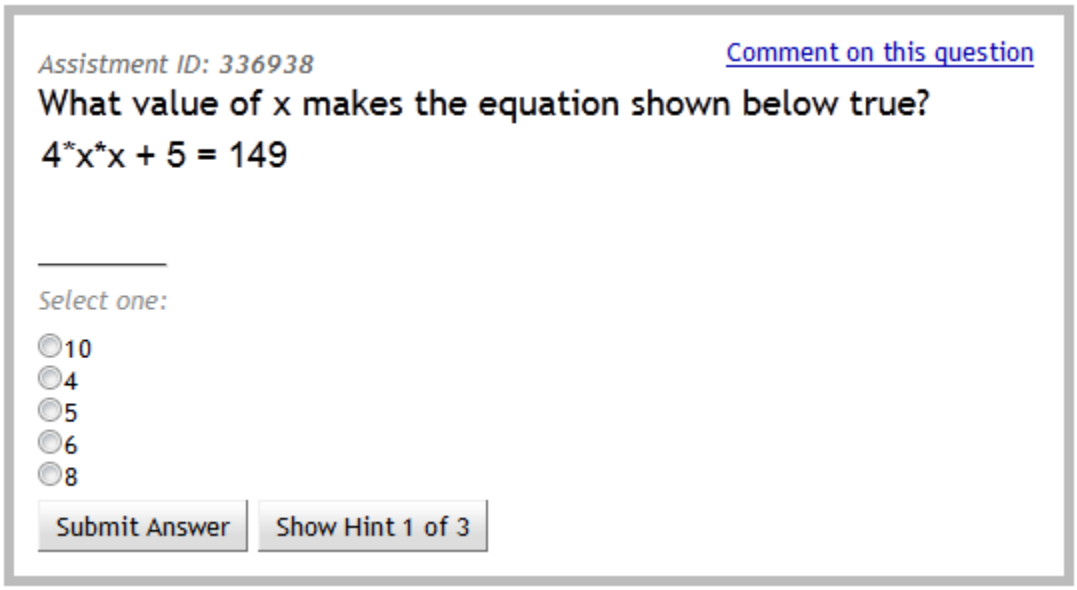
334355



- The answers are between 1 and 30.
- Expression: addition, subtraction and multiplication.
- One variable

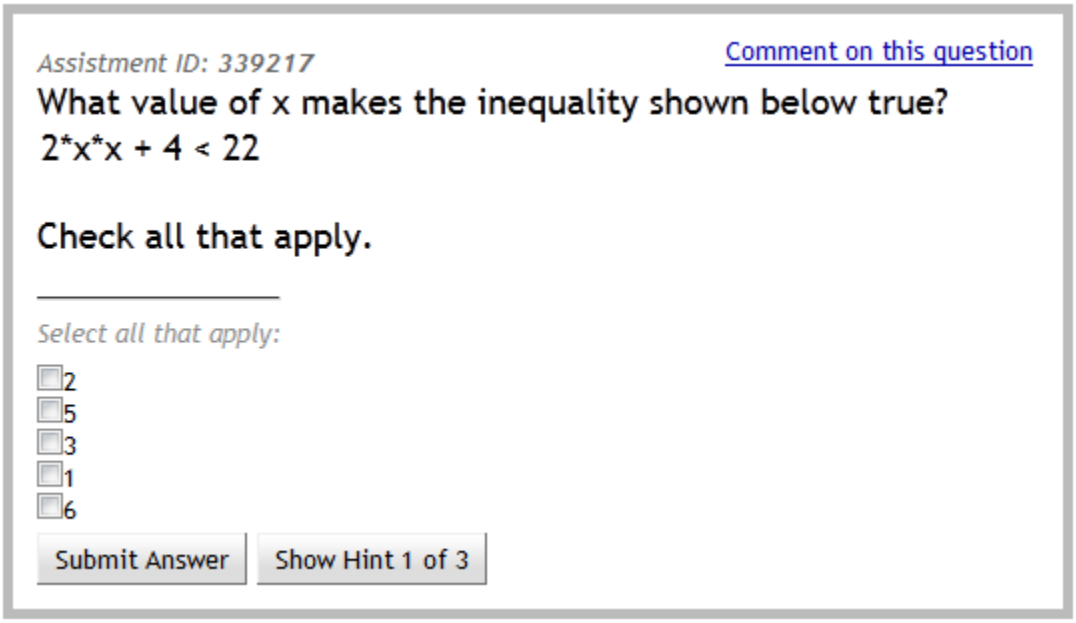
- Answer type: Check all that apply

336938



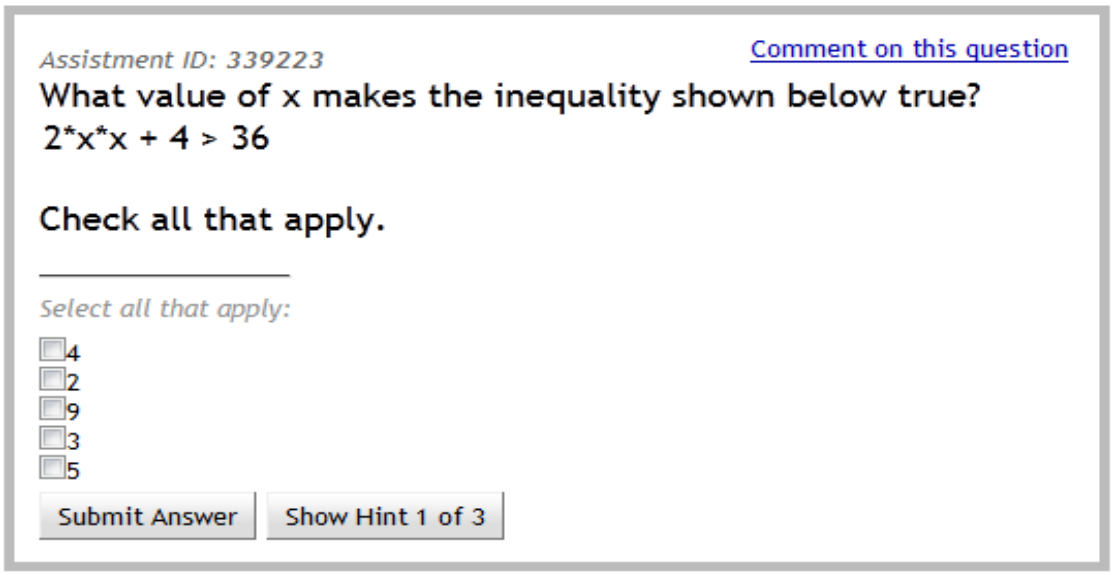
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

339217



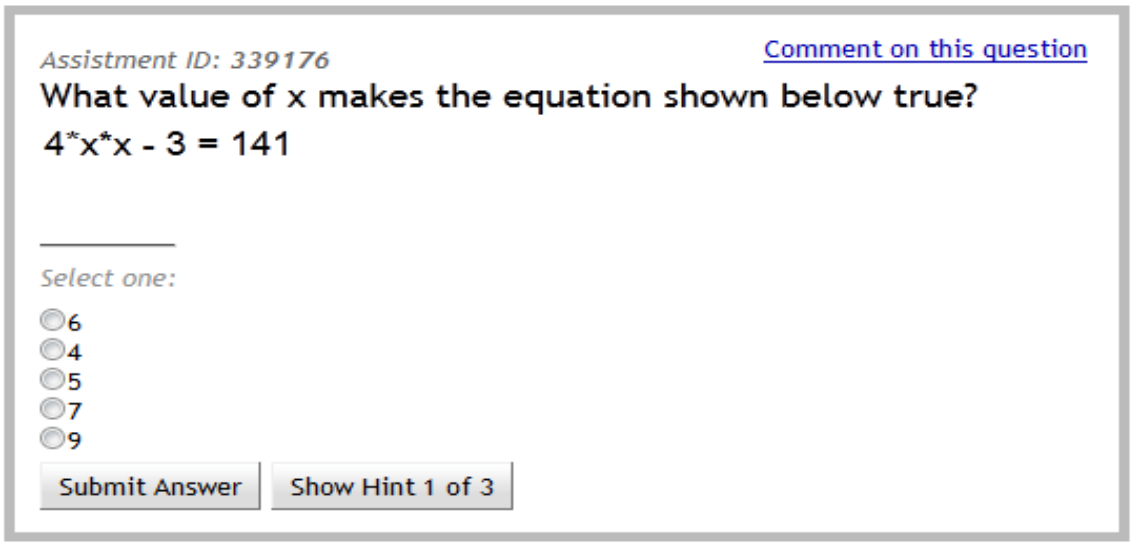
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

339223



- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

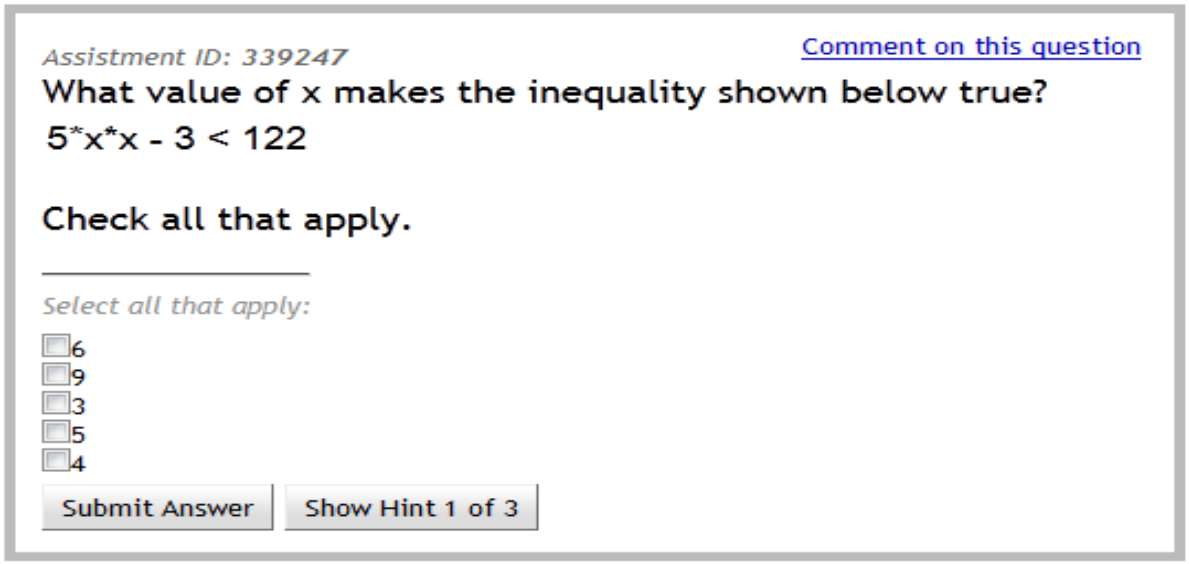
339176



- The answers are between 1 and 15.

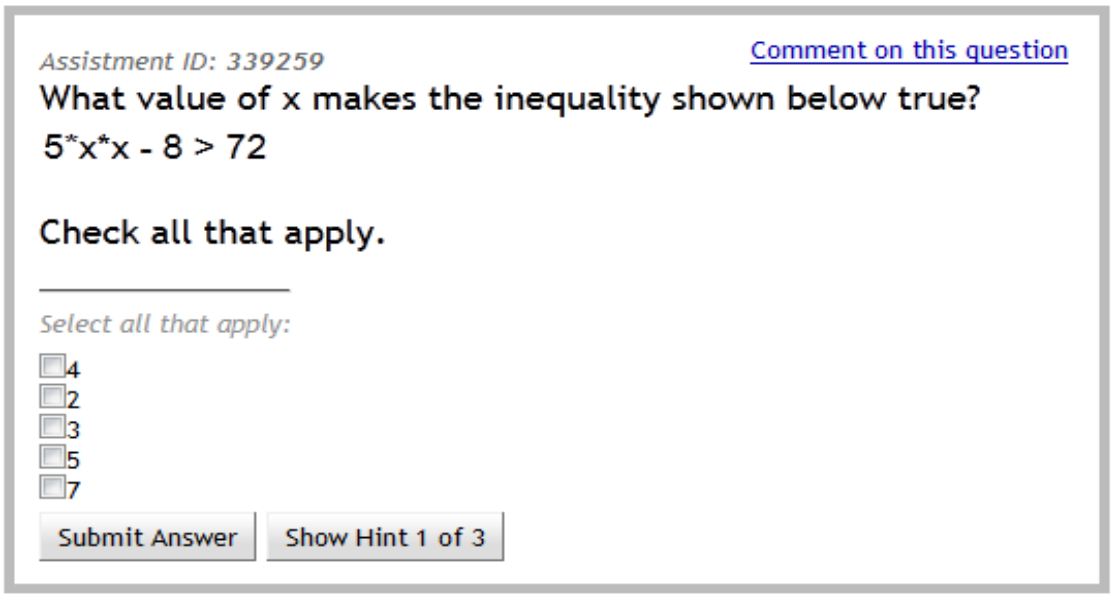
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

339247



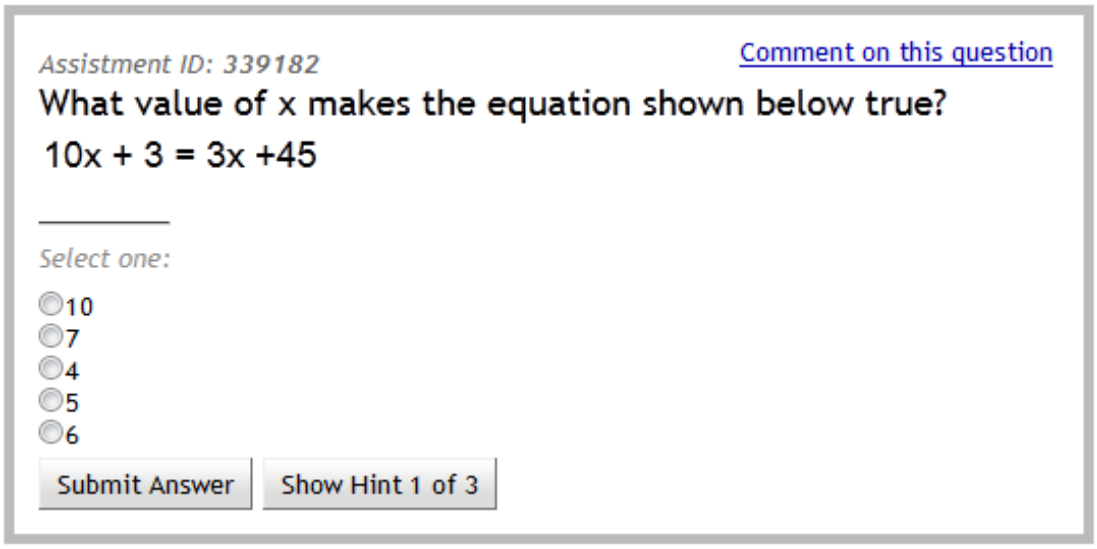
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

339259



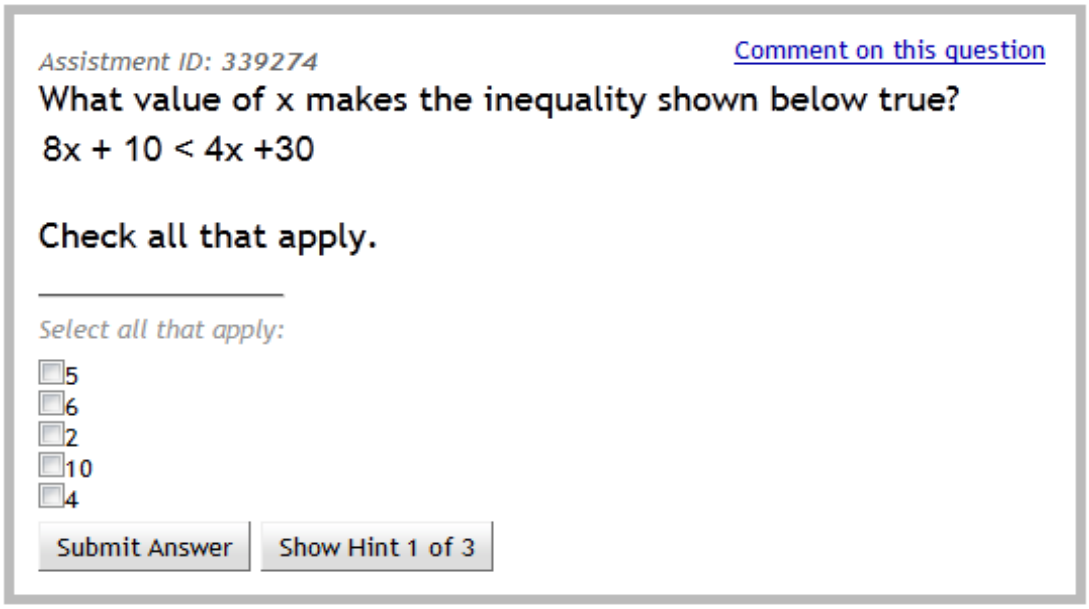
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

339182



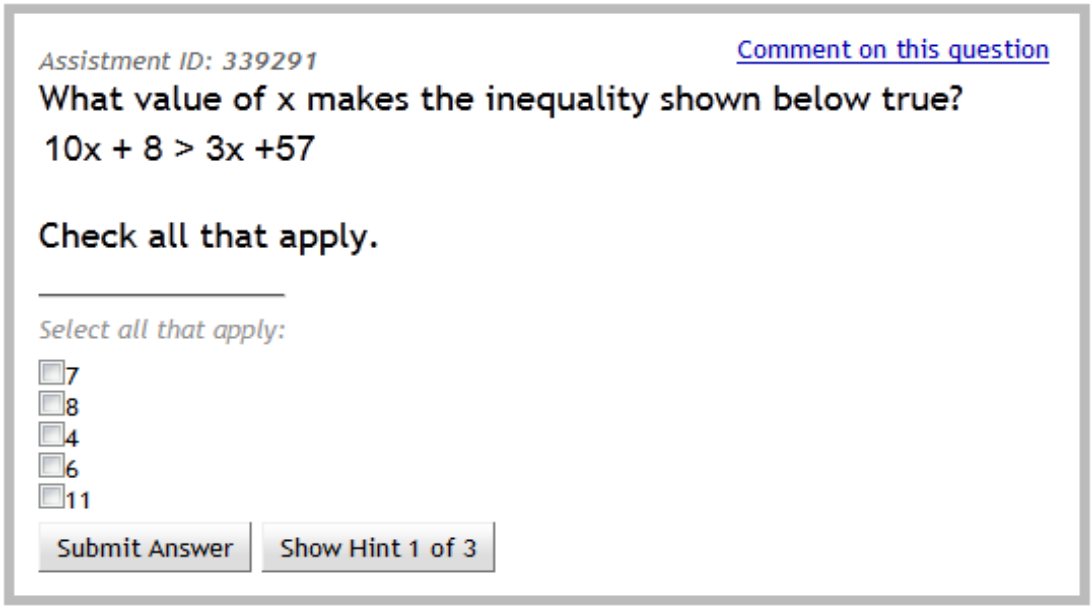
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

339274



- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

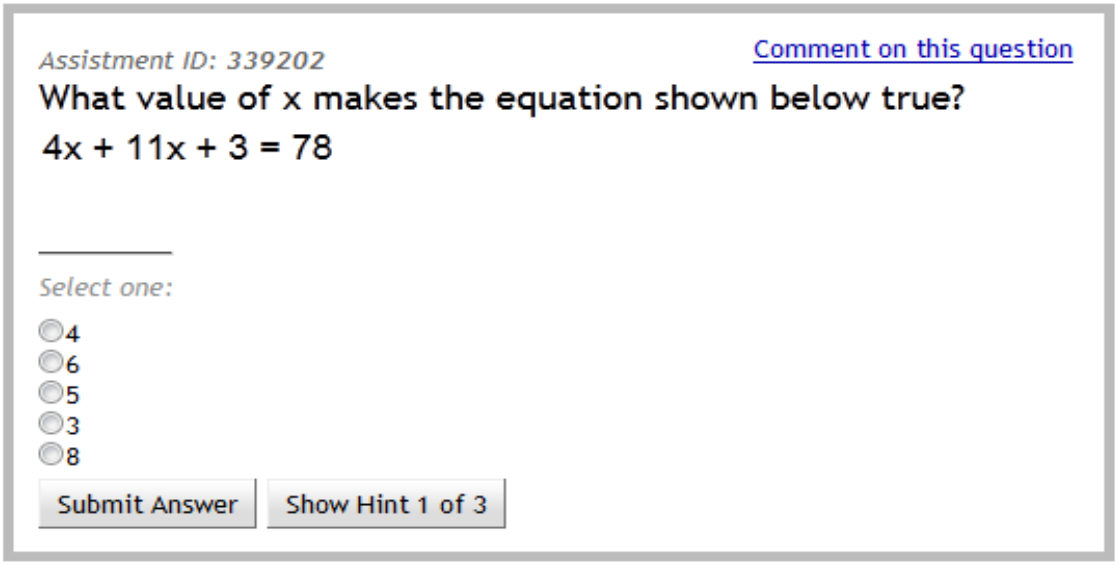
339291



- The answers are between 1 and 15.

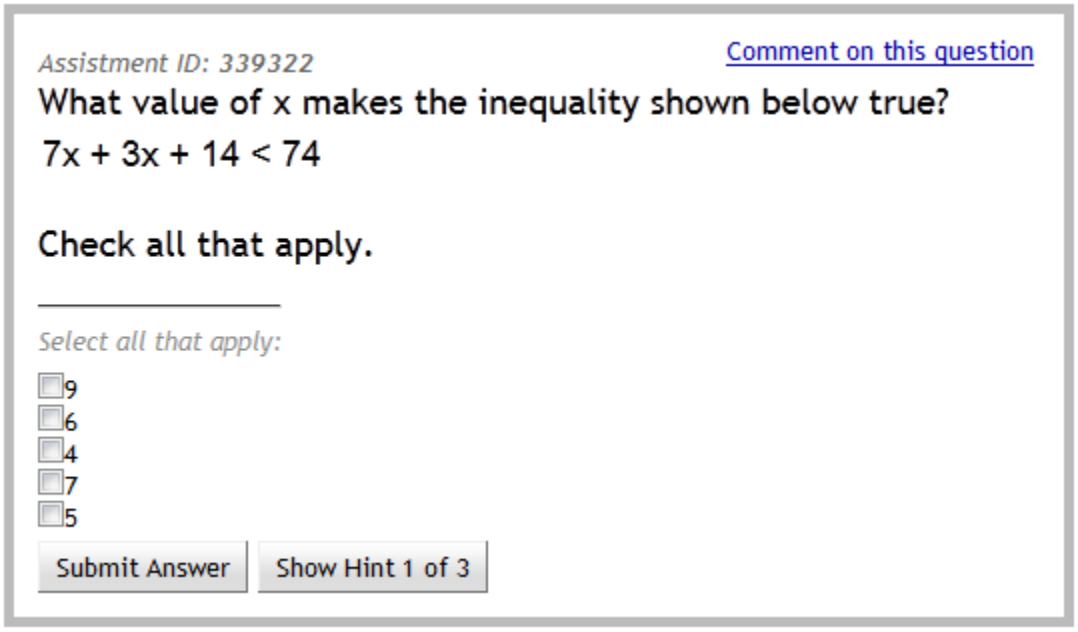
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

339202



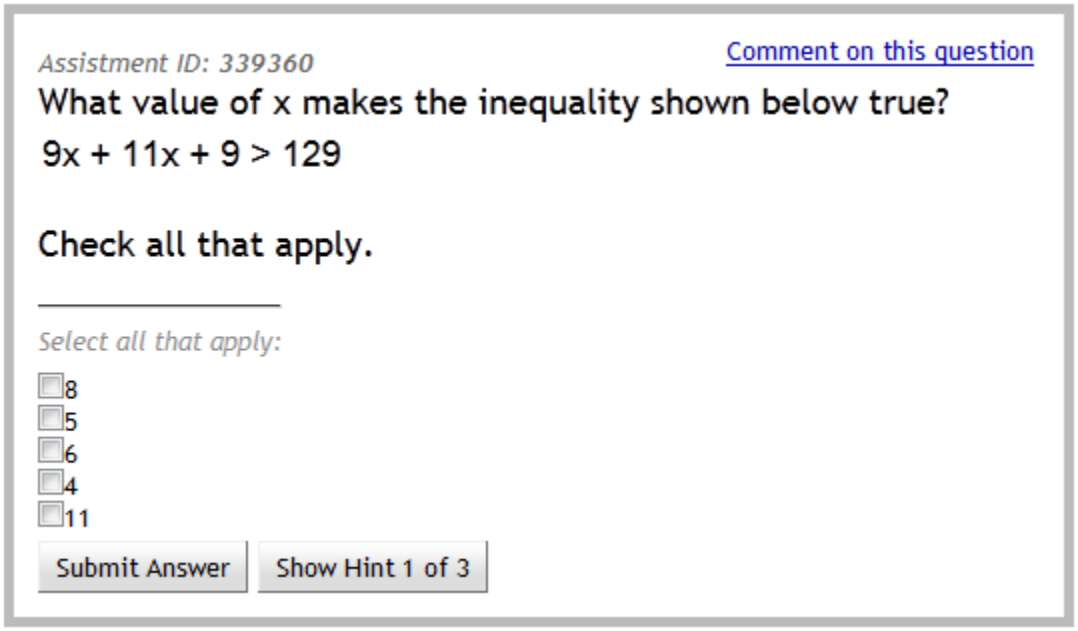
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

339322



- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

339360



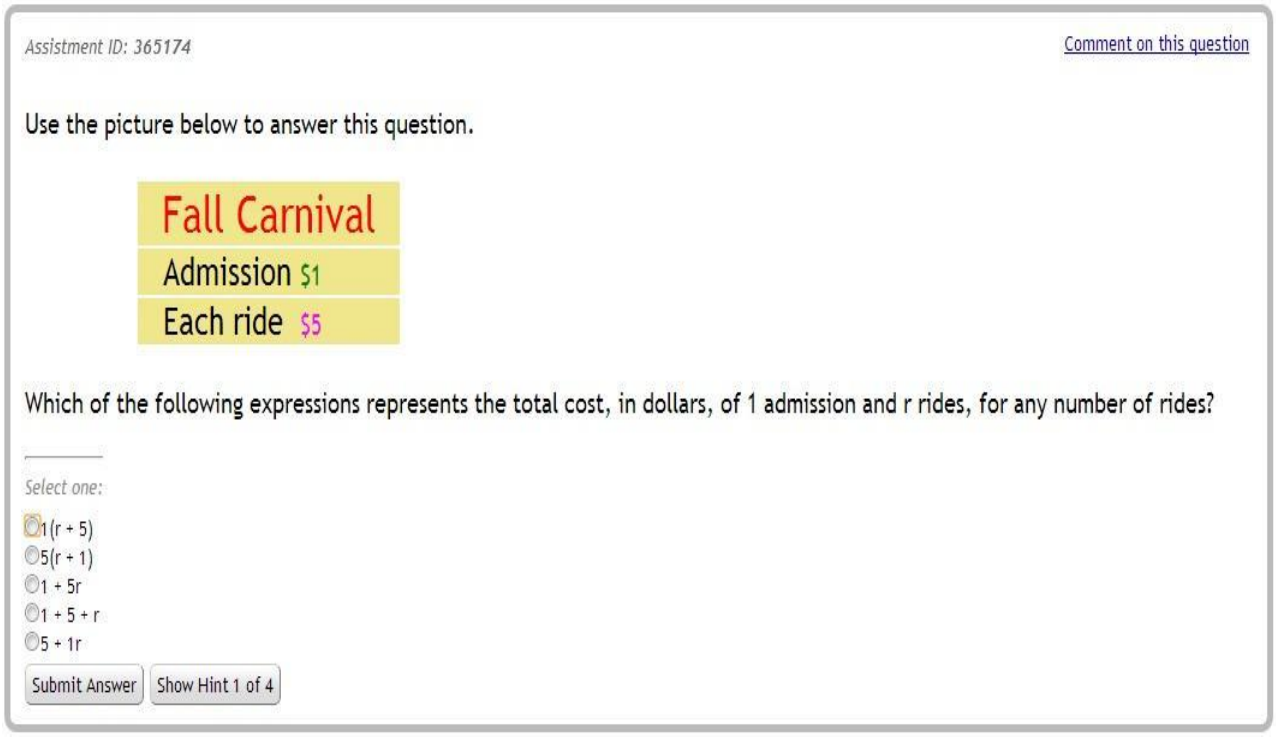
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

Skill	Class
Write Expressions for Real World Situations	6.EE.6

Mastery Problem Set	Number of Templates
54193	10
Number to Master	Number of Attempts
3 in-a-row	

Templates

365174

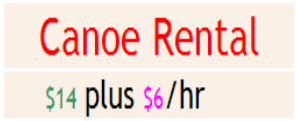


- The given numbers is between 1 and 15.
- Expression: addition and multiplication.
- One variable
- Answer type: Multiple Choices

331356

Assistment ID: 331356 Comment on this question

Use the picture below to answer this question.



Marion wants to rent a canoe to go out on a lake. The cost is $14 plus $6 for each hour.

Let n be the number of hours the canoe is rented.

Using numbers, symbols, and the variable *n*, write an expression for how much it would cost to rent the canoe for *n* hours.

Type your answer below (mathematical expression):

Submit Answer Show Hint 1 of 4

- The given numbers is between 1 and 15.
- Expression: addition and multiplication.
- One variable
- Answer type: Fill in

365177

Assistment ID: 365177 Comment on this question

The poster below shows the costs at a Six Flags tour.

Which of the following expressions represents the total cost, in dollars, of 1 admission and r rides, for any number of rides?

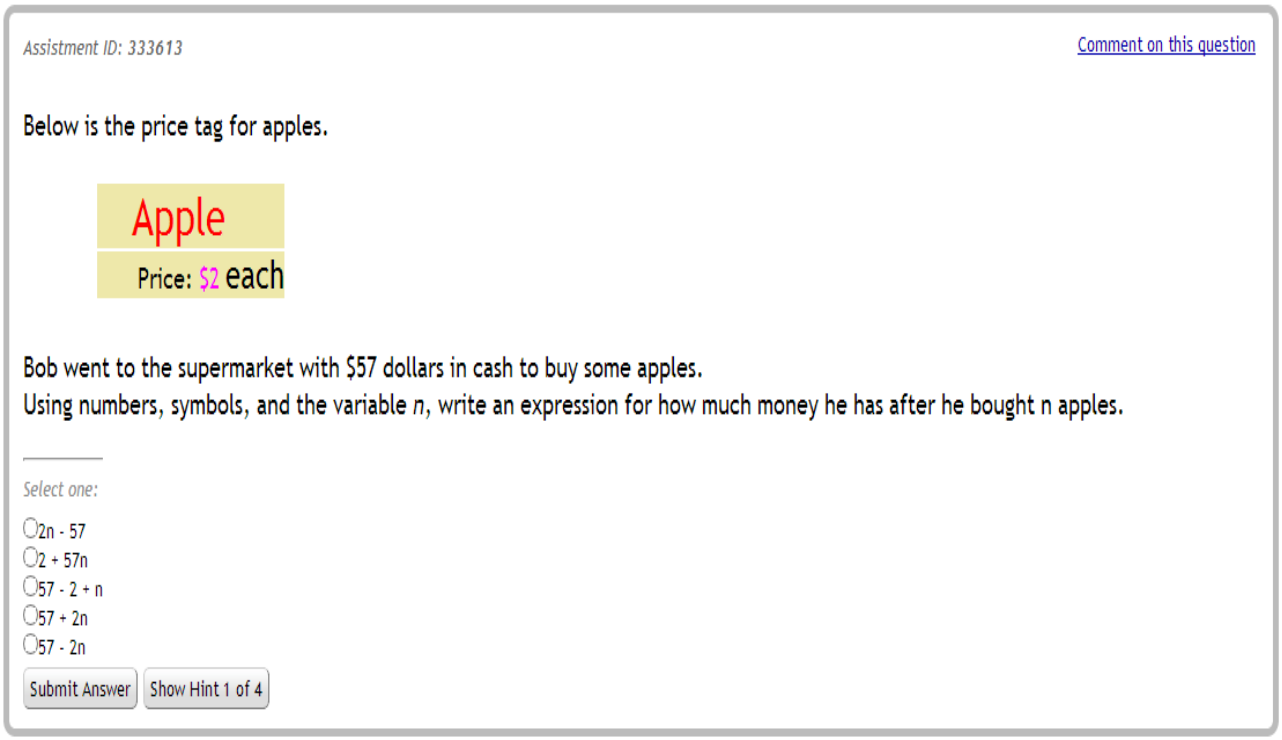
Select one:

- 2 + 11r
- 2(r + 11)
- 11 + 2 + r
- 11(r + 2)
- 11 + 2r

Submit Answer | Show Hint 1 of 4

- The given numbers is between 1 and 15.
- Expression: addition and multiplication.
- One variable
- Answer type: Multiple Choices

333613


Assistment ID: 333613

Comment on this question

Below is the price tag for apples.

Apple

Price: $2 each

Bob went to the supermarket with $57 dollars in cash to buy some apples.
Using numbers, symbols, and the variable *n*, write an expression for how much money he has after he bought n apples.

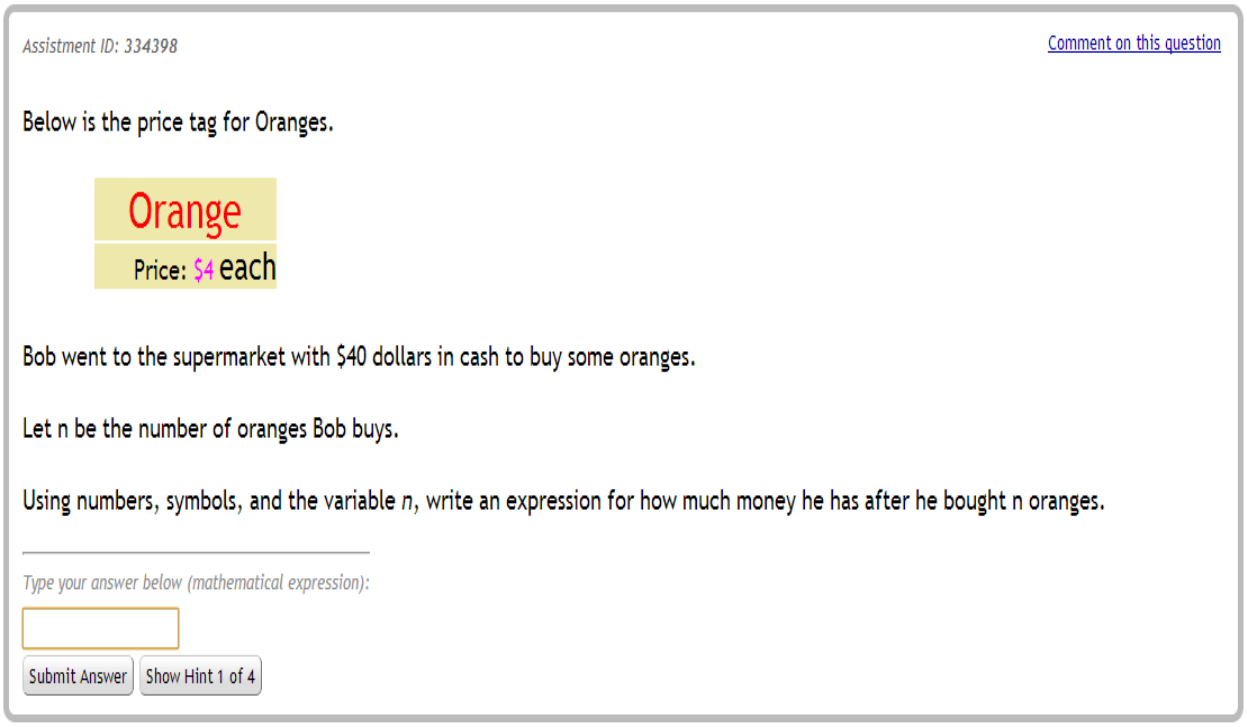
Select one:

- 2n - 57
- 2 + 57n
- 57 - 2 + n
- 57 + 2n
- 57 - 2n

Submit Answer | Show Hint 1 of 4

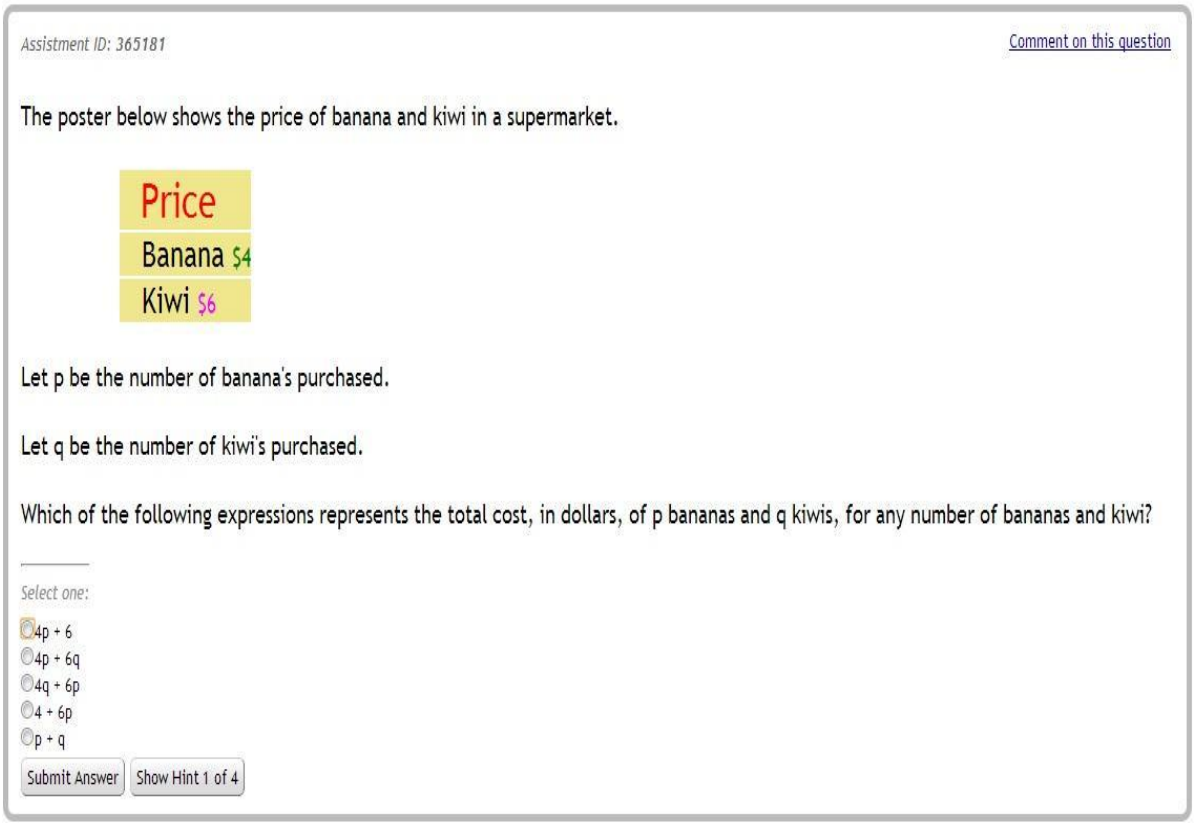
- The given numbers is between 2 and 60.
- Expression: subtraction and multiplication.
- One variable
- Answer type: Multiple Choice

334398



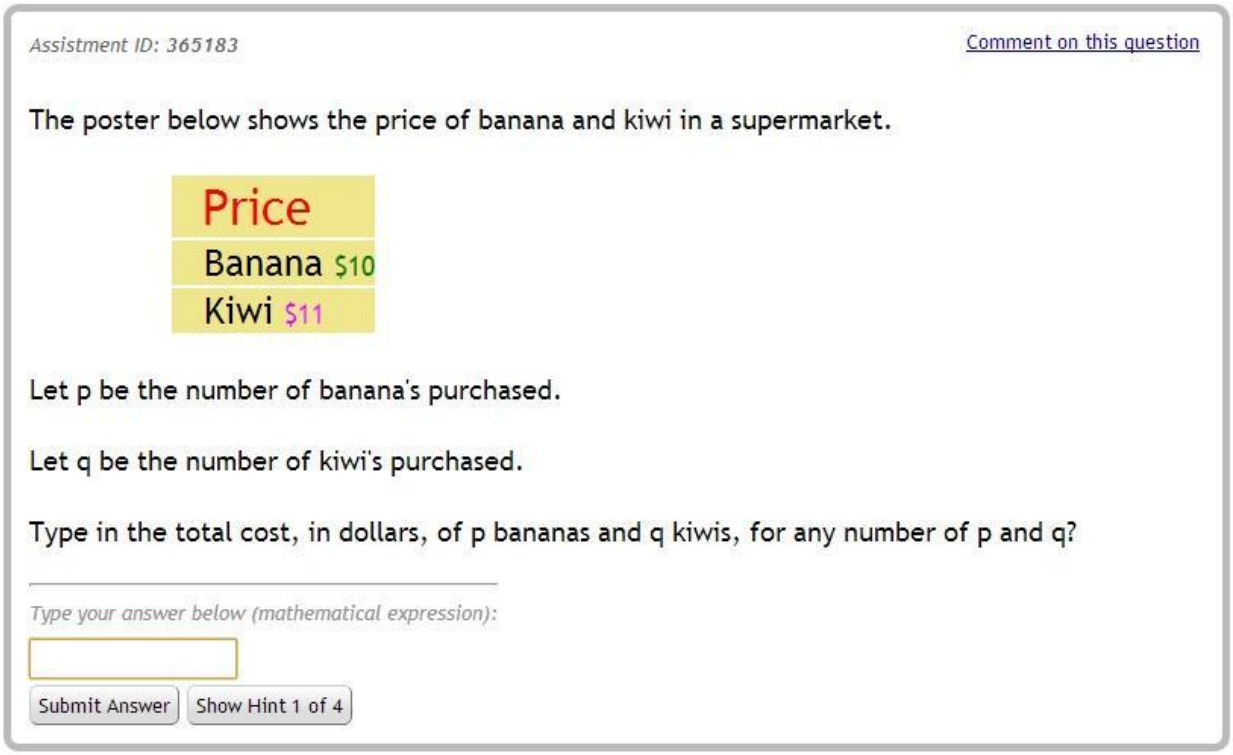
- The given numbers is between 2 and 60.
- Expression: subtraction and multiplication.
- One variable
- Answer type: Fill in

365181



- The given numbers is between 1 and 13.
- Expression: addition and multiplication.
- Two variables
- Answer type: Multiple Choices

365183



- The given numbers is between 1 and 13.
- Expression: addition and multiplication.
- Two variables
- Answer type: Fill in

334401

Assistment ID: 334401 Comment on this question

Bob makes 20 cookies and he wants to give them to a group of kids.

Let n be the number of kids in the group.

Using numbers, symbols, and the variable *n*, write an expression for how many cookies each kid receives.

Select one:

- 20 + n
- 20/n
- 20n
- 20 - n
- n/20

Submit Answer | Show Hint 1 of 2

- The given numbers is between 5 and 25.
- Expression: division.
- One variable
- Answer type: Multiple Choices

334402

Assistment ID: 334402 Comment on this question

Bob makes 5 cookies and he wants to give it to a group of kids.

Let n be the number of kids in the group.

Using numbers, symbols, and the variable *n*, write an expression for how many cookies each kid receives.

Type your answer below (mathematical expression):

Submit Answer Show Hint 1 of 2

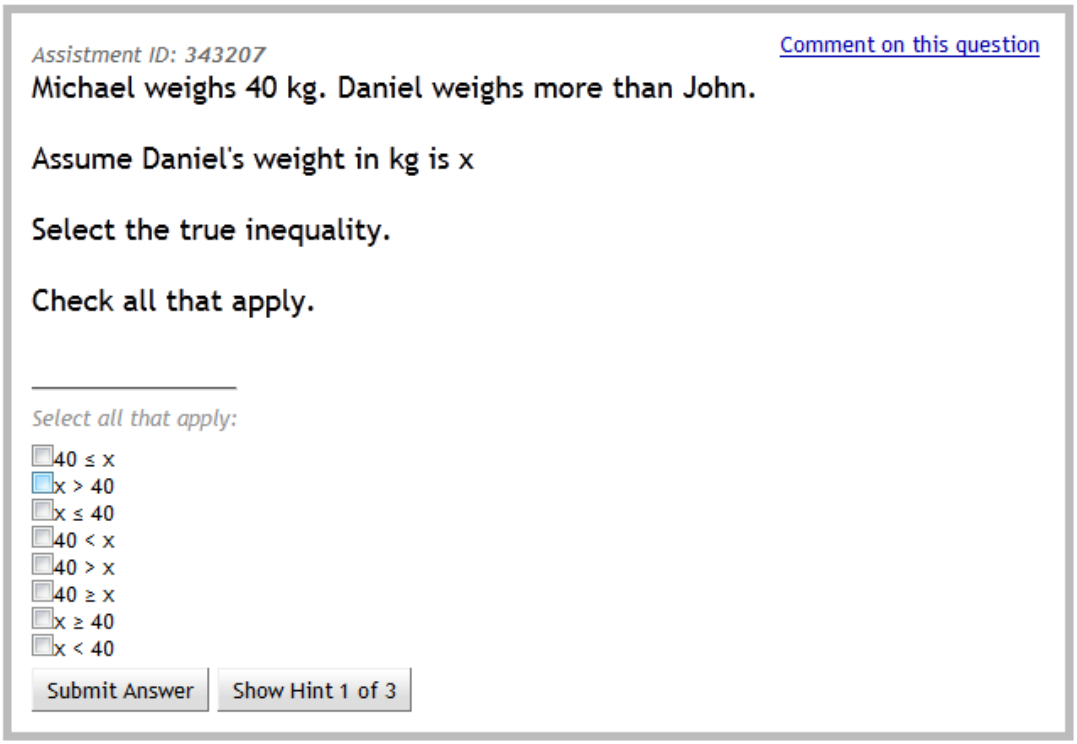
- The given numbers is between 5 and 25.
- Expression: division.
- One variable
- Answer type: Fill in

Skill	Class
Write an equation or inequality to represent a real-world problem.	6.EE.8

Mastery Problem Set	Number of Templates
	11
Number to Master	Number of Attempts
5 in-a-row	

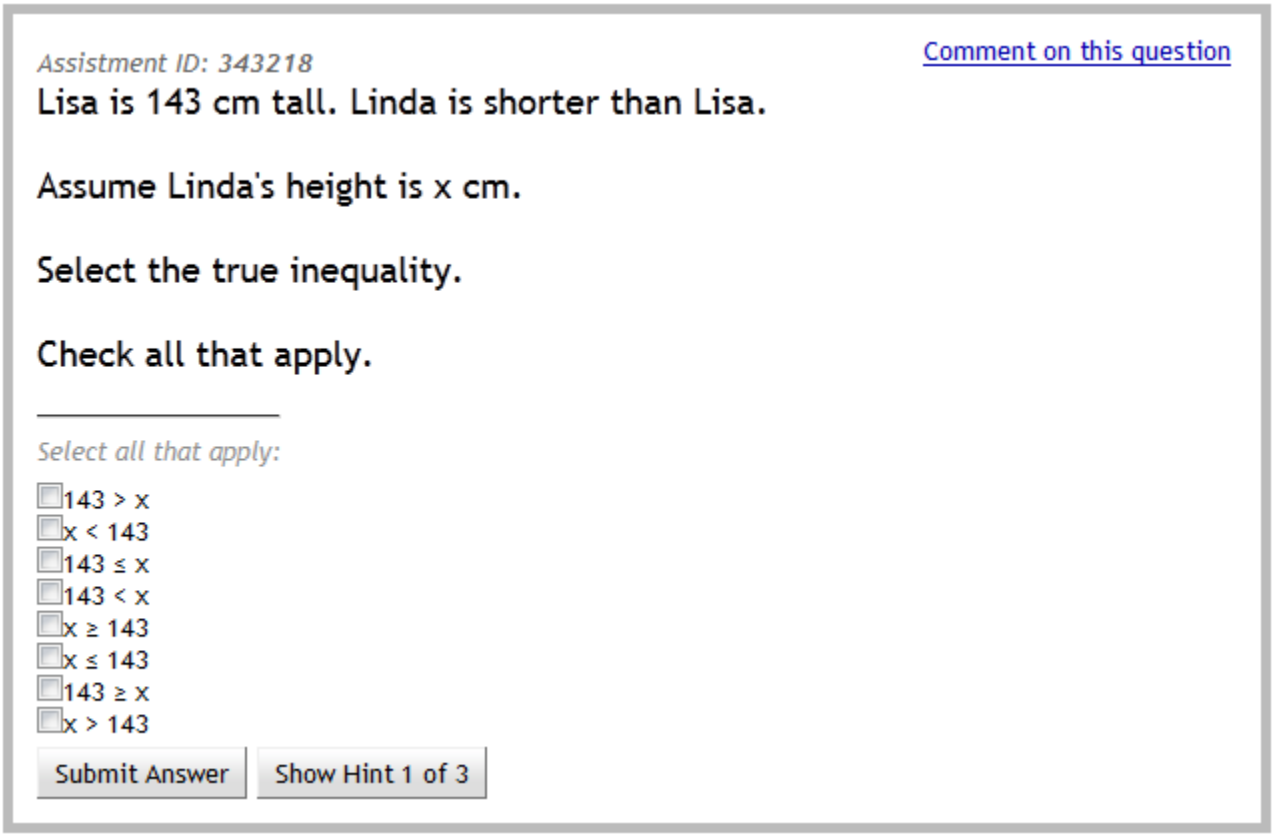
Templates

343207



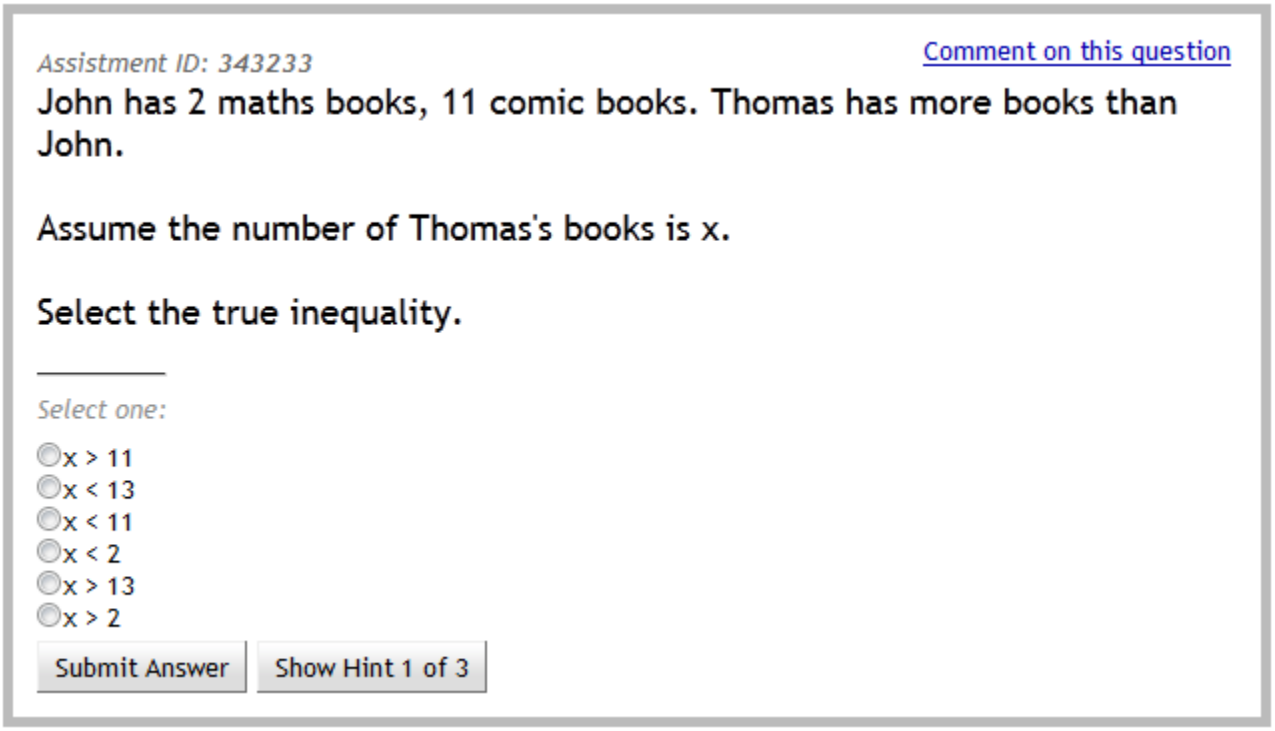
- The answers are between 1 and 25.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

343218



- The answers are between 1 and 25.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

343233



- The answers are between 1 and 25.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

343234

Assistment ID: 343234 Comment on this question

Richard has 5 black pens, 10 blue pens. Donald has fewer pens than Richard.

Assume the number of Donald's pens is x.

Select the true inequality.

_____

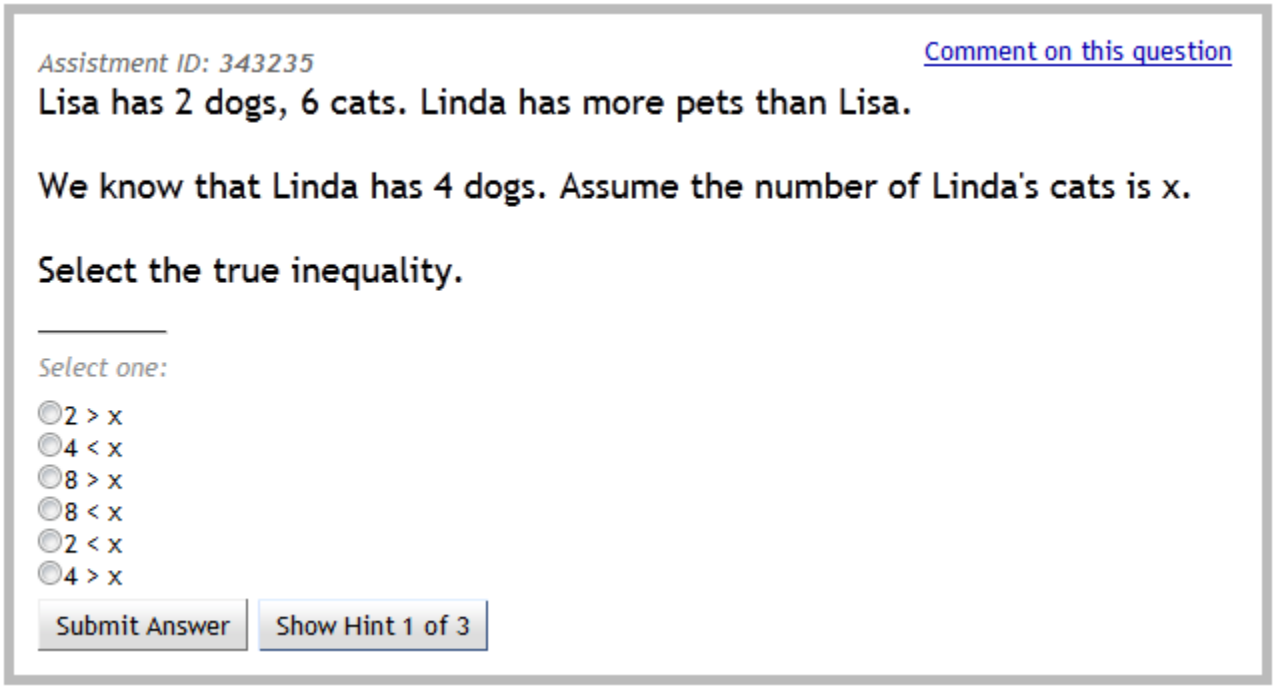
Select one:

- 15 > x
- 5 < x
- 5 > x
- 10 > x
- 10 < x
- 15 < x

Submit Answer | Show Hint 1 of 3

- The answers are between 1 and 30.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

343235



- The answers are between 1 and 30.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

343237

Assistment ID: 343237 Comment on this question

Elizabeth has 5 dogs. Karen has 12 cats. Paul has fewer pets than both of them.

We know that Paul has 3 cats. Assume the number of Paul's dogs is x.

Select the true inequality.

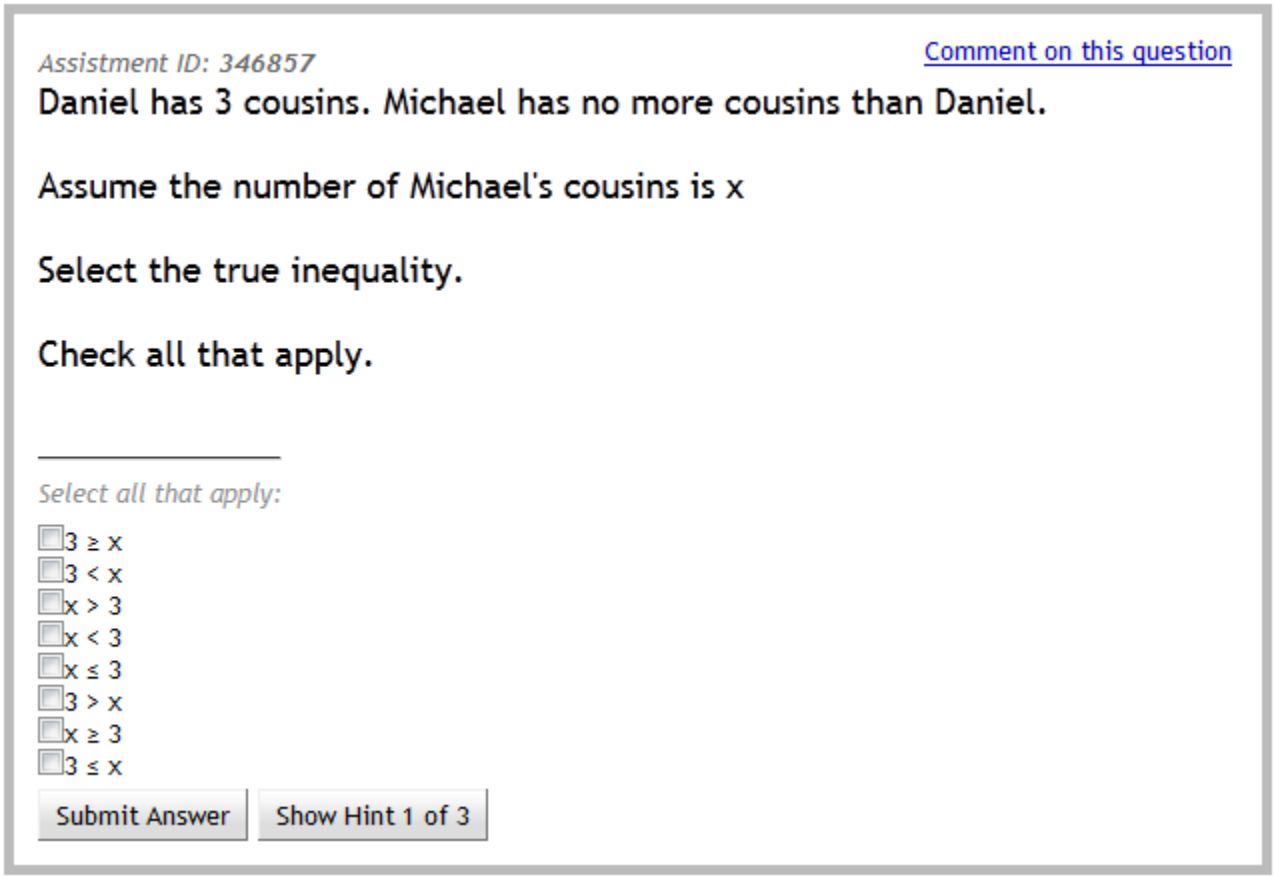
Select one:

- x<14
- x>14
- x<5
- x>17
- x>5
- x<17

Submit Answer | Show Hint 1 of 3

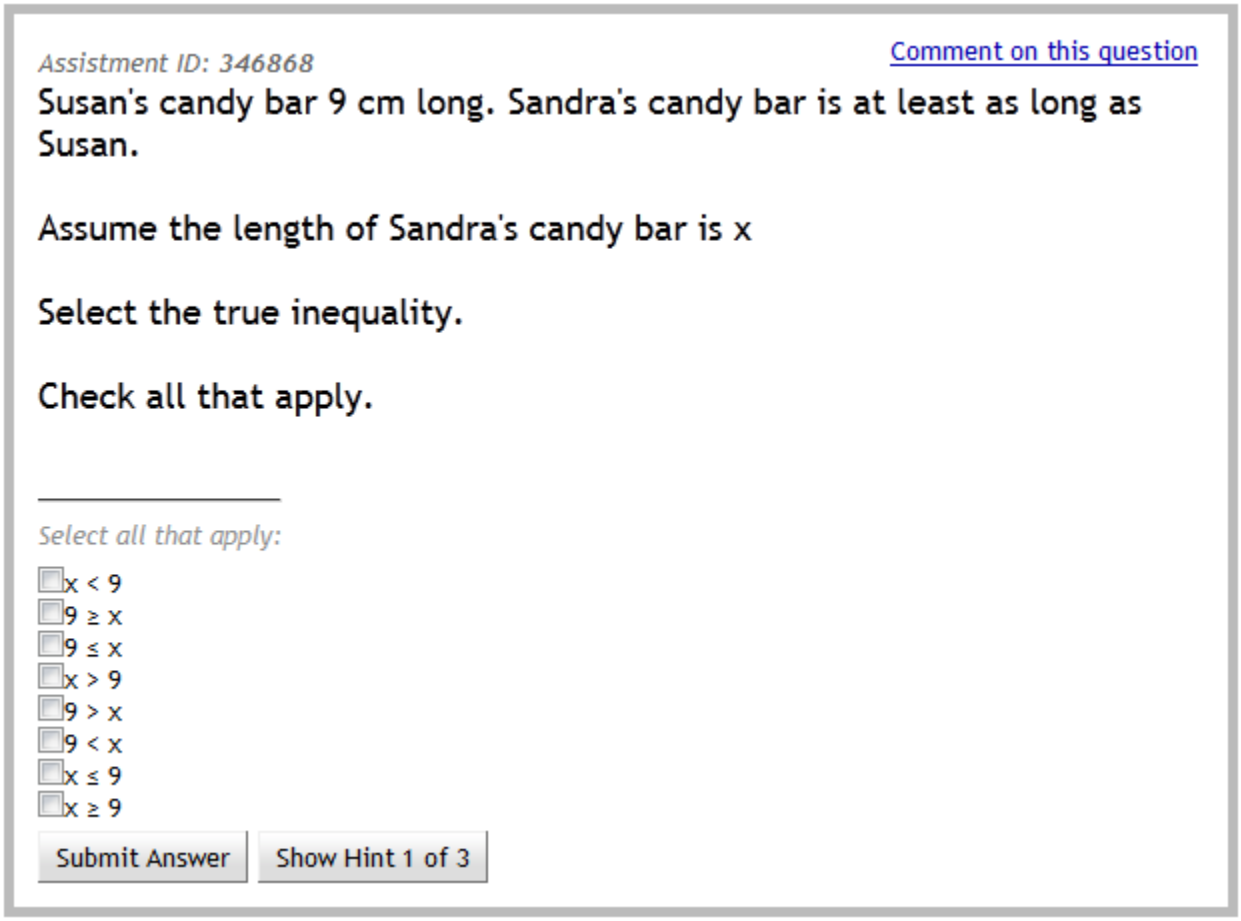
- The answers are between 1 and 30.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

346857



- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

346868



Assistment ID: 346868 Comment on this question

Susan's candy bar 9 cm long. Sandra's candy bar is at least as long as Susan.

Assume the length of Sandra's candy bar is x

Select the true inequality.

Check all that apply.

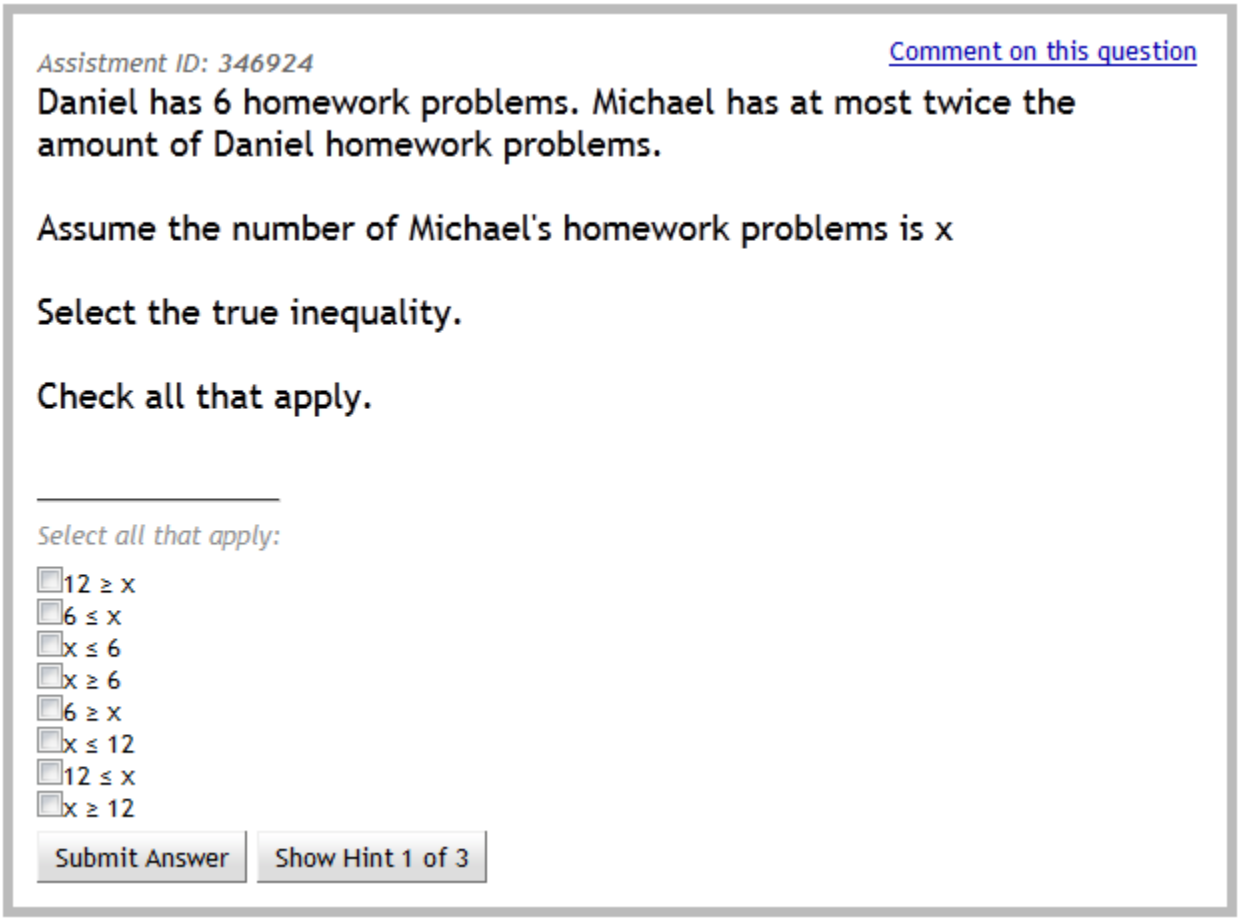
Select all that apply:

- x < 9
- 9 ≥ x
- 9 ≤ x
- x > 9
- 9 > x
- 9 < x
- x ≤ 9
- x ≥ 9

Submit Answer | Show Hint 1 of 3

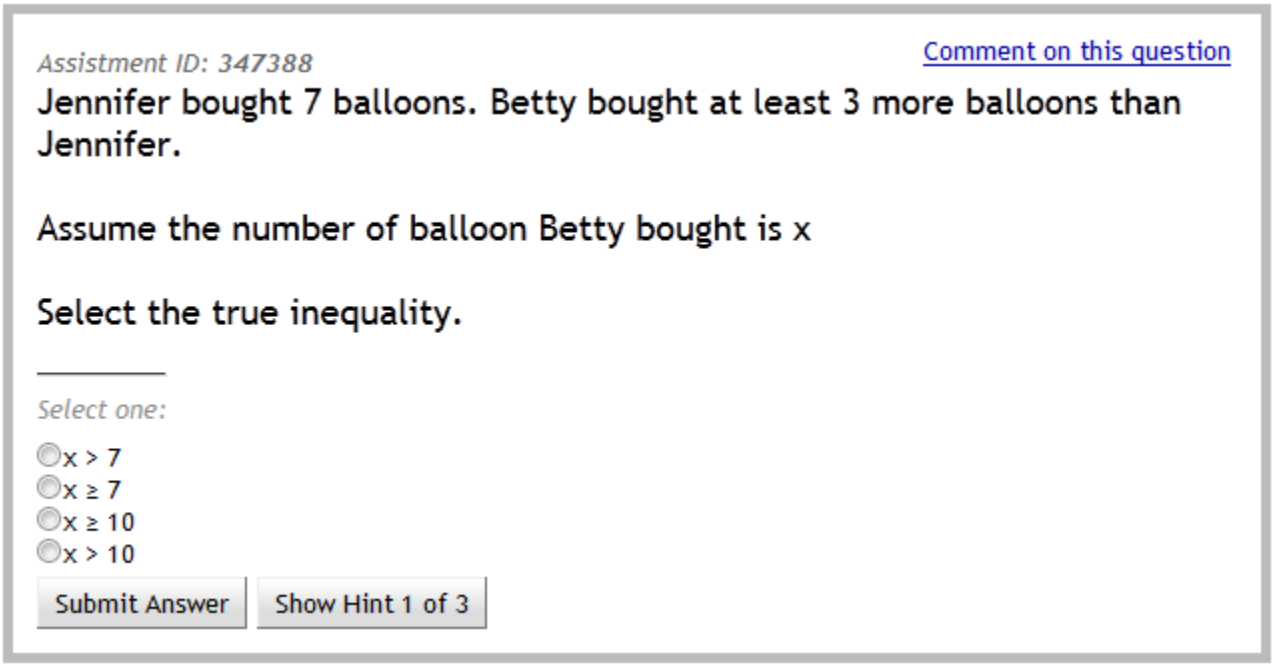
- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

346924



- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

346976



- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Multiple Choices

347388

Assistment ID: 347388 Comment on this question

Mary bought 8 balloons. Margaret bought at least 4 more balloons than Mary.

Assume the number of balloon Margaret bought is x

Select the true inequality.

_____

Select one:

- $x \geq 8$
- $x \geq 12$
- $x > 8$
- $x > 12$

Submit Answer | Show Hint 1 of 3

- The answers are between 1 and 15.
- Expression: addition, subtraction and multiplication.
- One variable
- Answer type: Check all that apply

Appendix B - Problem Set Summary

Skill	Class
Write Expressions	6.EE.2a

1) Assistment #340269 "340269 - 6.EE.2a - No 1"

Write an expression for:

"Subtract x from %v{a}".

Algebra:

✓ %v{a}-x

Hints:

- Remember x could represent any number.

Write the espression for x = 3

- If you choose x = 3.

The calculation "Subtract 3 from %v{a}" is: %v{a} - 3

- Similarly, the calculation "Subtract x from %v{a}" is: %v{a} - x

Type in %v{a}-x

---

2) Assistment #340270 "340270 - 6.EE.2a - No 2"

Write an expression for:

"Add x to %v{a}".

Algebra:

✓ %v{a}+x

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

The calculation "Add 3 to %v{a}" is: %v{a} + 3

- Similarly, the calculation "Add x to %v{a}" is: %v{a} + x

Type in %v{a}+x

---

3) Assistment #340271 "340271 - 6.EE.2a - No 3"

Write an expression for:

"%v{a} divided by x".

Algebra:

✓ %v{a}/x

Hints:

- Remember x could represent any number.

Write the espression for x = 3

- If you choose x = 3.

The calculation "%v{a} divided by 3" is: %v{a}/3

- Similarly, the calculation "%v{a} divided by x" is: %v{a}/x

Type in %v{a}/x

---

4) Assistment #340272 "340272 - 6.EE.2a - No 4"

Write an expression for:

"Multiply x by %v{a}".

Algebra:

✓ x*%v{a}

Hints:

- Remember x could represent any number.

Write the espression for x = 3

- If you choose x = 3.

The calculation "Multiply 3 by %v{a}" is: 3*%v{a}

- Similarly, the calculation "Multiply x by %v{a}" is: x*%v{a}

Type in x*%v{a}

---

5) Assistment #345530 "345530 - 6.EE.2a - No 5"

Write an expression for:

"%v{a} more than %v{b} times x".

Algebra:

✓ %v{a}+x*%v{b}

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "%v{b} times 3" is: %v{b}*3

Then, the expression "%v{a} more than %v{b} times 3" is: %v{a} + %v{b}*3

- Similarly, the expression "%v{b} times x" is: %v{b}*x

Then, the expression "%v{a} more than %v{b} times x" is: %v{a} + %v{b}*x

Type in %v{a}+%v{b}x

---

6) Assistment #345541 "345541 - 6.EE.2a - No 6"

Write an expression for:

"%v{b} times the sum of x and %v{a}"

Algebra:

✓ %v{b}(x+%v{a})

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "the sum of 3 and %v{a}" is: 3+%v{a}

Then, the expression "%v{b} times the sum of 3 and %v{a}" is: %v{b} * (3+%v{a})

- Similarly, the expression "the sum of x and %v{a}" is: x+%v{a}

Then, the expression "%v{b} times the sum of x and %v{a}" is: %v{b} * (x+%v{a})

Type in %v{b}(x+%v{a})

---

7) Assistment #345558 "345558 - 6.EE.2a - No 7"

Write an expression for:

"%v{a} less than the product of %v{b} and x"

Algebra:

✓ x*%v{b}-%v{a}

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "the product of %v{b} and 3" is: %v{b}*3

Then, the expression "%v{a} less than the product of %v{b} and 3" is: %v{b}*3 - %v{a}

- Similarly, the expression "the product of %v{b} and x" is: %v{b}*x

Then, the expression "%v{a} less than the product of %v{b} and x" is: %v{b}*x - %v{a}

Type in %v{b}x-%v{a}

---

8) Assistment #345577 "345577 - 6.EE.2a - No 8"

Write an expression for:

"%v{b} times the quantity x minus %v{a}"

Algebra:

✓ %v{b}*(x-%v{a})

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "the quantity 3 minus %v{a}" is: 3-%v{a}

Then, the expression "%v{b} times the quantity 3 minus %v{a}" is: %v{b} * (3-%v{a})

- Similarly, the expression "the difference between x and %v{a}" is: x-%v{a}

Then, the expression "%v{b} times the quantity x minus %v{a}" is: %v{b} * (x-%v{a})

Type in %v{b}(x-%v{a})

---

9) Assistment #345602 "345602 - 6.EE.2a - No 9"

Write an expression for:

"%v{a} more than the quotient of x and %v{b}".

Algebra:

✓ %v{a}+x/%v{b}

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "the quotient of 3 and %v{b}" is: 3/%v{b}

Then, the expression "%v{a} more than the quotient of 3 and %v{b}" is: %v{a} + 3/%v{b}

- Similarly, the expression "the quotient of x and %v{b}" is: x/%v{b}

Then, the expression "%v{a} more than the quotient of x and %v{b}" is: %v{a} + x/%v{b}

Type in %v{a}+x/%v{b}

---

10) Assistment #345603 "345603 - 6.EE.2a - No 10"

Write an expression for:

"%v{a} less than the quotient of x and %v{b}".

Algebra:

✓ x/%v{b}-%v{a}

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "the quotient of 3 and %v{b}" is: 3/%v{b}

Then, the expression "%v{a} less than the quotient of 3 and %v{b}" is: 3/%v{b} - %v{a}

- Similarly, the expression "the quotient of x and %v{b}" is: x/%v{b}

Then, the expression "%v{a} less than the quotient of x and %v{b}" is: x/%v{b} - %v{a}

Type in x/%v{b}-%v{a}

---

11) Assistment #345604 "345604 - 6.EE.2a - No 11"

Write an expression for:

"the sum of x and %v{a}, then divided by %v{b}".

Algebra:

✓ (x+%v{a})/%v{b}

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "the sum of 3 and %v{a}" is: 3 + %v{a}

Then, the expression "the sum of 3 and %v{a} divided by %v{b}" is: (3+%v{a})/%v{b}

- Similarly, the expression "the sum of x and %v{a}" is: x + %v{a}

Then, the expression "the sum of x and %v{a} divided by %v{b}" is: (x+%v{a})/%v{b}

Type in (x+%v{a})/%v{b}

---

12) Assistment #345610 "345610 - 6.EE.2a - No 12"

Write an expression for:

"the difference between x and %v{a}, then divided by %v{b}".

Algebra:

✓ (x-%v{a})/%v{b}

Hints:

- Remember x could represent any number.

Write the expression for x = 3

- If you choose x = 3.

First, the expression "the difference between 3 and %v{a}" is: 3 - %v{a}

Then, the expression "the difference between 3 and %v{a} divided by %v{b}" is: (3-%v{a})/%v{b}

- Similarly, the expression "the difference between x and %v{a}" is: x - %v{a}

Then, the expression "the difference between x and %v{a} divided by %v{b}" is: (x-%v{a})/%v{b}

Type in (x-%v{a})/%v{b}

Skill	Class
Solving an equation or inequality using substitution	6.EE.5

1) Assistment #330769 "330769 - 6.EE.5 - Solution to Equation"

What value of x makes the equation shown below true?

%v{num1}x + %v{num2} = %v{num3}

Multiple choice:

✓ %v{ans}

✗ %v{ans2}

✗ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the equation is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} + %v{num2} = %v{num3}

%v{num1*ans2} + %v{num2} = %v{num3}

%v{num1*ans2+num2} = %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2} = %v{num3}

%v{num1*ans2} + %v{num2} = %v{num3}

%v{num1*ans2+num2} = %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2} = %v{num3}

%v{num1*ans3} + %v{num2} = %v{num3}

%v{num1*ans3+num2} = %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2} = %v{num3}

%v{num1*ans} + %v{num2} = %v{num3}

%v{num1*ans+num2} = %v{num3}

This is the correct solution. Choose **%v{ans}**.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2} = %v{num3}

%v{num1*ans4} + %v{num2} = %v{num3}

%v{num1*ans4+num2} = %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2} = %v{num3}

%v{num1*ans5} + %v{num2} = %v{num3}

%v{num1*ans5+num2} = %v{num3}

This is wrong.

---

2) Assistment #334339 "334339 - 6.EE.5 - Solution to Inequalities - Greater than"

What value of x makes the inequality shown below true?

%v{num1}x + %v{num2} > %v{num3}

Check all that apply.

Check all that apply:

✗ %v{ans}

✓ %v{ans2}

✗ %v{ans3}

✗ %v{ans4}

✓ %v{ans5}

Hints:

- Replace x with all the answered provided and see if the inequality is true.
- Suppose we replace x with %v{ans}.

%v{num1}*%v{ans} + %v{num2} > %v{num3}

%v{num1*ans} + %v{num2} > %v{num3}

%v{num1*ans+num2} > %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans2}, %v{ans3}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2} > %v{num3}

%v{num1*ans2} + %v{num2} > %v{num3}

%v{num1*ans2+num2} > %v{num3}

This is true. Choose **%v{ans2}**.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2} > %v{num3}

%v{num1*ans3} + %v{num2} > %v{num3}

%v{num1*ans3+num2} > %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2} > %v{num3}

%v{num1*ans} + %v{num2} > %v{num3}

%v{num1*ans+num2} > %v{num3}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2} > %v{num3}

%v{num1*ans4} + %v{num2} > %v{num3}

%v{num1*ans4+num2} > %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2} > %v{num3}

%v{num1*ans5} + %v{num2} > %v{num3}

%v{num1*ans5+num2} > %v{num3}

This is true. Choose **%v{ans5}**.

---

3) Assistment #332798 "332798 - 6.EE.5 - Solution to Inequalities - Less than"

What value of x makes the inequality shown below true?

%v{num1}x + %v{num2} < %v{num3}

Check all that apply

Check all that apply:

✘ %v{ans}

✗ %v{ans2}

✓ %v{ans3}

✓ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the answered provided and see if the inequality is true.
- Suppose we replace x with %v{ans}.

%v{num1}*%v{ans} + %v{num2} < %v{num3}

%v{num1*ans} + %v{num2} < %v{num3}

%v{num1*ans+num2} < %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans2}, %v{ans3}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2} < %v{num3}

%v{num1*ans2} + %v{num2} < %v{num3}

%v{num1*ans2+num2} < %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2} < %v{num3}

%v{num1*ans3} + %v{num2} < %v{num3}

%v{num1*ans3+num2} < %v{num3}

This is true. Choose **%v{ans3}**.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2} < %v{num3}

%v{num1*ans} + %v{num2} < %v{num3}

%v{num1*ans+num2} < %v{num3}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2} < %v{num3}

%v{num1*ans4} + %v{num2} < %v{num3}

%v{num1*ans4+num2} < %v{num3}

This is true. Choose **%v{ans4}**.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2} < %v{num3}

%v{num1*ans5} + %v{num2} < %v{num3}

%v{num1*ans5+num2} < %v{num3}

This is wrong.

---

4) Assistment #334340 "334340 - 6.EE.5 - Solution to Equation 2"

What value of x makes the equation shown below true?

%v{num1}x - %v{num2} = %v{num3}

Multiple choice:

✓ %v{ans}

✗ %v{ans2}

✗ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the equation is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} - %v{num2} = %v{num3}

%v{num1*ans2} - %v{num2} = %v{num3}

%v{num1*ans2-num2} = %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} - %v{num2} = %v{num3}

%v{num1*ans2} - %v{num2} = %v{num3}

%v{num1*ans2-num2} = %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} - %v{num2} = %v{num3}

%v{num1*ans3} - %v{num2} = %v{num3}

%v{num1*ans3-num2} = %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} - %v{num2} = %v{num3}

%v{num1*ans} - %v{num2} = %v{num3}

%v{num1*ans-num2} = %v{num3}

This is the correct solution. Choose **%v{ans}**.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} - %v{num2} = %v{num3}

%v{num1*ans4} - %v{num2} = %v{num3}

%v{num1*ans4-num2} = %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} - %v{num2} = %v{num3}

%v{num1*ans5} - %v{num2} = %v{num3}

%v{num1*ans5-num2} = %v{num3}

This is wrong.

5) Assistment #334351 "334351 - 6.EE.5 - Solution to Inequalities - Less than 2"

What value of x makes the inequality shown below true?

%v{num1}x - %v{num2} < %v{num3}

Check all that apply.

Check all that apply:

✗ %v{ans}

✗ %v{ans2}

✓ %v{ans3}

✓ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the answered provided and see if the inequality is true.
- Suppose we replace x with %v{ans}.

%v{num1}*%v{ans} - %v{num2} < %v{num3}

%v{num1*ans} - %v{num2} < %v{num3}

%v{num1*ans-num2} < %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans2}, %v{ans3}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} - %v{num2} < %v{num3}

%v{num1*ans2} - %v{num2} < %v{num3}

%v{num1*ans2-num2} < %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} - %v{num2} < %v{num3}

%v{num1*ans3} - %v{num2} < %v{num3}

%v{num1*ans3-num2} < %v{num3}

This is true. Choose **%v{ans3}**.

Replacing x with %v{ans}

%v{num1}*%v{ans} - %v{num2} < %v{num3}

%v{num1*ans} - %v{num2} < %v{num3}

%v{num1*ans-num2} < %v{num3}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} - %v{num2} < %v{num3}

%v{num1*ans4} - %v{num2} < %v{num3}

%v{num1*ans4-num2} < %v{num3}

This is true. Choose **%v{ans4}**.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} - %v{num2} < %v{num3}

%v{num1*ans5} - %v{num2} < %v{num3}

%v{num1*ans5-num2} < %v{num3}

This is wrong.

---

6) Assistment #334355 "334355 - 6.EE.5 - Solution to Inequalities - Greater than 2"

What value of x makes the inequality shown below true?

%v{num1}x - %v{num2} > %v{num3}

Check all that apply:

✗ %v{ans}

✓ %v{ans2}

✗ %v{ans3}

✗ %v{ans4}

✓ %v{ans5}

Hints:

- Replace x with all the answered provided and see if the inequality is true.
- Suppose we replace x with %v{ans}.

%v{num1}*%v{ans} - %v{num2} > %v{num3}

%v{num1*ans} - %v{num2} > %v{num3}

%v{num1*ans-num2} > %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans2}, %v{ans3}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} - %v{num2} > %v{num3}

%v{num1*ans2} - %v{num2} > %v{num3}

%v{num1*ans2-num2} > %v{num3}

This is true. Choose **%v{ans2}**.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} - %v{num2} > %v{num3}

%v{num1*ans3} - %v{num2} > %v{num3}

%v{num1*ans3-num2} > %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} - %v{num2} > %v{num3}

%v{num1*ans} - %v{num2} > %v{num3}

%v{num1*ans-num2} > %v{num3}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} - %v{num2} > %v{num3}

%v{num1*ans4} - %v{num2} > %v{num3}

%v{num1*ans4-num2} > %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} - %v{num2} > %v{num3}

%v{num1*ans5} - %v{num2} > %v{num3}

%v{num1*ans5-num2} > %v{num3}

This is true. Choose **%v{ans5}**.

---

7) Assistment #336938 "336938 - 6.EE.5 - Solution to Equation 3"

What value of x makes the equation shown below true?

%v{num1}*x*x + %v{num2} = %v{num3}

Multiple choice:

✓ %v{ans}

✗ %v{ans2}

✗ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the equation is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2}*%v{ans2} + %v{num2} = %v{num3}

%v{num1*ans2*ans2} + %v{num2} = %v{num3}

%v{num1*ans2*ans2+num2} = %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2}*%v{ans2} + %v{num2} = %v{num3}

%v{num1*ans2*ans2} + %v{num2} = %v{num3}

%v{num1*ans2*ans2+num2} = %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3}*%v{ans3} + %v{num2} = %v{num3}

%v{num1*ans3*ans3} + %v{num2} = %v{num3}

%v{num1*ans3*ans3+num2} = %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans}*%v{ans} + %v{num2} = %v{num3}

%v{num1*ans*ans} + %v{num2} = %v{num3}

%v{num1*ans*ans+num2} = %v{num3}

This is the correct solution. Choose **%v{ans}**.

Replacing x with %v{ans4}

%v{num1}*%v{ans4}*%v{ans4} + %v{num2} = %v{num3}

%v{num1*ans4*ans4} + %v{num2} = %v{num3}

%v{num1*ans4*ans4+num2} = %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5}*%v{ans5} + %v{num2} = %v{num3}

%v{num1*ans5*ans5} + %v{num2} = %v{num3}

%v{num1*ans5*ans5+num2} = %v{num3}

This is wrong.

---

8) Assistment #339217 "339217 - 6.EE.5 - Solution to Inequalities - Less than 3"

What value of x makes the inequality shown below true?

%v{num1}*x*x + %v{num2} < %v{num3}

Check all that apply.

Check all that apply:

- ✘ %v{ans}
- ✘ %v{ans2}
- ✘ %v{ans3}

✓ %v{ans4}

✓ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2}*%v{ans2} + %v{num2} < %v{num3}

%v{num1*ans2*ans2} + %v{num2} < %v{num3}

%v{num1*ans2*ans2+num2} < %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2}*%v{ans2} + %v{num2} < %v{num3}

%v{num1*ans2*ans2} + %v{num2} < %v{num3}

%v{num1*ans2*ans2+num2} < %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3}*%v{ans3} + %v{num2} < %v{num3}

%v{num1*ans3*ans3} + %v{num2} < %v{num3}

%v{num1*ans3*ans3+num2} < %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans}*%v{ans} + %v{num2} < %v{num3}

%v{num1*ans*ans} + %v{num2} < %v{num3}

%v{num1*ans*ans+num2} < %v{num3}

This is the wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4}*%v{ans4} + %v{num2} < %v{num3}

%v{num1*ans4*ans4} + %v{num2} < %v{num3}

%v{num1*ans4*ans4+num2} < %v{num3}

This is the correct solution. Choose **%v{ans4}**.

Replacing x with %v{ans5}

%v{num1}*%v{ans5}*%v{ans5} + %v{num2} < %v{num3}

%v{num1*ans5*ans5} + %v{num2} < %v{num3}

%v{num1*ans5*ans5+num2} < %v{num3}

This is the correct solution. Choose **%v{ans5}**.

---

9) Assistment #339223 "339223 - 6.EE.5 - Solution to Inequalities - Greater than 3"

What value of x makes the inequality shown below true?

%v{num1}*x*x + %v{num2} > %v{num3}

Check all that apply.

Check all that apply:

✗ %v{ans}

✓ %v{ans2}

✓ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2}*%v{ans2} + %v{num2} > %v{num3}

%v{num1*ans2*ans2} + %v{num2} > %v{num3}

%v{num1*ans2*ans2+num2} > %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2}*%v{ans2} + %v{num2} > %v{num3}

%v{num1*ans2*ans2} + %v{num2} > %v{num3}

%v{num1*ans2*ans2+num2} > %v{num3}

This is correct solution. Choose **%v{ans2}**.

Replacing x with %v{ans3}

%v{num1}*%v{ans3}*%v{ans3} + %v{num2} > %v{num3}

%v{num1*ans3*ans3} + %v{num2} > %v{num3}

%v{num1*ans3*ans3+num2} > %v{num3}

This is correct solution. Choose **%v{ans3}**.

Replacing x with %v{ans}

%v{num1}*%v{ans}*%v{ans} + %v{num2} > %v{num3}

%v{num1*ans*ans} + %v{num2} > %v{num3}

%v{num1*ans*ans+num2} > %v{num3}

This is the wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4}*%v{ans4} + %v{num2} > %v{num3}

%v{num1*ans4*ans4} + %v{num2} > %v{num3}

%v{num1*ans4*ans4+num2} > %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5}*%v{ans5} + %v{num2} > %v{num3}

%v{num1*ans5*ans5} + %v{num2} > %v{num3}

%v{num1*ans5*ans5+num2} > %v{num3}

This is wrong.

10) Assistment #339176 "339176 - 6.EE.5 - Solution to Equation 4"

What value of x makes the equation shown below true?

%v{num1}*x*x - %v{num2} = %v{num3}

Multiple choice:

✓ %v{ans}

✗ %v{ans2}

✗ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the equation is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2}*%v{ans2} - %v{num2} = %v{num3}

%v{num1*ans2*ans2} - %v{num2} = %v{num3}

%v{num1*ans2*ans2-num2} = %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2}*%v{ans2} - %v{num2} = %v{num3}

%v{num1*ans2*ans2} - %v{num2} = %v{num3}

%v{num1*ans2*ans2-num2} = %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3}*%v{ans3} - %v{num2} = %v{num3}

%v{num1*ans3*ans3} - %v{num2} = %v{num3}

%v{num1*ans3*ans3-num2} = %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans}*%v{ans} - %v{num2} = %v{num3}

%v{num1*ans*ans} - %v{num2} = %v{num3}

%v{num1*ans*ans-num2} = %v{num3}

This is the correct solution. Choose **%v{ans}**.

Replacing x with %v{ans4}

%v{num1}*%v{ans4}*%v{ans4} - %v{num2} = %v{num3}

%v{num1*ans4*ans4} - %v{num2} = %v{num3}

%v{num1*ans4*ans4-num2} = %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5}*%v{ans5} - %v{num2} = %v{num3}

%v{num1*ans5*ans5} - %v{num2} = %v{num3}

%v{num1*ans5*ans5-num2} = %v{num3}

This is wrong.

---

11) Assistment #339247 "339247 - 6.EE.5 - Solution to Inequalities - Less than 4"

What value of x makes the inequality shown below true?

%v{num1}*x*x - %v{num2} < %v{num3}

Check all that apply.

Check all that apply:

✗ %v{ans}

✗ %v{ans2}

✗ %v{ans3}

✓ %v{ans4}

✓ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2}*%v{ans2} - %v{num2} < %v{num3}

%v{num1*ans2*ans2} - %v{num2} < %v{num3}

%v{num1*ans2*ans2-num2} < %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2}*%v{ans2} - %v{num2} < %v{num3}

%v{num1*ans2*ans2} - %v{num2} < %v{num3}

%v{num1*ans2*ans2-num2} < %v{num3}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3}*%v{ans3} - %v{num2} < %v{num3}

%v{num1*ans3*ans3} - %v{num2} < %v{num3}

%v{num1*ans3*ans3-num2} < %v{num3}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans}*%v{ans} - %v{num2} < %v{num3}

%v{num1*ans*ans} - %v{num2} < %v{num3}

%v{num1*ans*ans-num2} < %v{num3}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4}*%v{ans4} - %v{num2} < %v{num3}

%v{num1*ans4*ans4} - %v{num2} < %v{num3}

%v{num1*ans4*ans4-num2} < %v{num3}

This is the correct solution. Choose **%v{ans4}**.

Replacing x with %v{ans5}

%v{num1}*%v{ans5}*%v{ans5} - %v{num2} < %v{num3}

%v{num1*ans5*ans5} - %v{num2} < %v{num3}

%v{num1*ans5*ans5-num2} < %v{num3}

This is the correct solution. Choose **%v{ans5}**.

---

12) Assistment #339259 "339259 - 6.EE.5 - Solution to Inequalities - Greater than 4"

What value of x makes the inequality shown below true?

%v{num1}*x*x - %v{num2} > %v{num3}

Check all that apply.

Check all that apply:

✗ %v{ans}

✓ %v{ans2}

✓ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2}*%v{ans2} - %v{num2} > %v{num3}

%v{num1*ans2*ans2} - %v{num2} > %v{num3}

%v{num1*ans2*ans2-num2} > %v{num3}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2}*%v{ans2} - %v{num2} > %v{num3}

%v{num1*ans2*ans2} - %v{num2} > %v{num3}

%v{num1*ans2*ans2-num2} > %v{num3}

This is the correct solution. Choose **%v{ans2}**.

Replacing x with %v{ans3}

%v{num1}*%v{ans3}*%v{ans3} - %v{num2} > %v{num3}

%v{num1*ans3*ans3} - %v{num2} > %v{num3}

%v{num1*ans3*ans3-num2} > %v{num3}

This is the correct solution. Choose **%v{ans3}**.

Replacing x with %v{ans}

%v{num1}*%v{ans}*%v{ans} - %v{num2} > %v{num3}

%v{num1*ans*ans} - %v{num2} > %v{num3}

%v{num1*ans*ans-num2} > %v{num3}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4}*%v{ans4} - %v{num2} > %v{num3}

%v{num1*ans4*ans4} - %v{num2} > %v{num3}

%v{num1*ans4*ans4-num2} > %v{num3}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5}*%v{ans5} - %v{num2} > %v{num3}

%v{num1*ans5*ans5} - %v{num2} > %v{num3}

%v{num1*ans5*ans5-num2} > %v{num3}

This is wrong.

---

13) Assistment #339182 "339182 - 6.EE.5 - Solution to Equation 5"

What value of x makes the equation shown below true?

%v{num1}x + %v{num2} = %v{num3}x +%v{num4}

Multiple choice:

✓ %v{ans}

✗ %v{ans2}

✘ %v{ans3}

✘ %v{ans4}

✘ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the equation is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} + %v{num2} = %v{num3}*%v{ans2} + %v{num4}

%v{num1*ans2} + %v{num2} = %v{num3*ans2} + %v{num4}

%v{num1*ans2+num2} = %v{num3*ans2+num4}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2} = %v{num3}*%v{ans2} + %v{num4}

%v{num1*ans2} + %v{num2} = %v{num3*ans2} + %v{num4}

%v{num1*ans2+num2} = %v{num3*ans2+num4}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2} = %v{num3}*%v{ans3} + %v{num4}

%v{num1*ans3} + %v{num2} = %v{num3*ans3} + %v{num4}

%v{num1*ans3+num2} = %v{num3*ans3+num4}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2} = %v{num3}*%v{ans} + %v{num4}

%v{num1*ans} + %v{num2} = %v{num3*ans} + %v{num4}

%v{num1*ans+num2} = %v{num3*ans+num4}

This is the correct solution. Choose **%v{ans}**.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2} = %v{num3}*%v{ans4} + %v{num4}

%v{num1*ans4} + %v{num2} = %v{num3*ans4} + %v{num4}

%v{num1*ans4+num2} = %v{num3*ans4+num4}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2} = %v{num3}*%v{ans5} + %v{num4}

%v{num1*ans5} + %v{num2} = %v{num3*ans5} + %v{num4}

%v{num1*ans5+num2} = %v{num3*ans5+num4}

This is wrong.

---

14) Assistment #339274 "339274 - 6.EE.5 - Solution to Inequalities - Less than 5"

What value of x makes the inequality shown below true?

%v{num1}x + %v{num2} < %v{num3}x +%v{num4}

Check all that apply.

Check all that apply:

✗ %v{ans}

✗ %v{ans2}

✗ %v{ans3}

✓ %v{ans4}

✓ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} + %v{num2} < %v{num3}*%v{ans2} + %v{num4}

%v{num1*ans2} + %v{num2} < %v{num3*ans2} + %v{num4}

%v{num1*ans2+num2} < %v{num3*ans2+num4}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2} < %v{num3}*%v{ans2} + %v{num4}

%v{num1*ans2} + %v{num2} < %v{num3*ans2} + %v{num4}

%v{num1*ans2+num2} < %v{num3*ans2+num4}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2} < %v{num3}*%v{ans3} + %v{num4}

%v{num1*ans3} + %v{num2} < %v{num3*ans3} + %v{num4}

%v{num1*ans3+num2} < %v{num3*ans3+num4}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2} < %v{num3}*%v{ans} + %v{num4}

%v{num1*ans} + %v{num2} < %v{num3*ans} + %v{num4}

%v{num1*ans+num2} < %v{num3*ans+num4}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2} < %v{num3}*%v{ans4} + %v{num4}

%v{num1*ans4} + %v{num2} < %v{num3*ans4} + %v{num4}

%v{num1*ans4+num2} < %v{num3*ans4+num4}

This is the correct solution. Choose **%v{ans4}**.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2} < %v{num3}*%v{ans5} + %v{num4}

%v{num1*ans5} + %v{num2} < %v{num3*ans5} + %v{num4}

%v{num1*ans5+num2} < %v{num3*ans5+num4}

This is the correct solution. Choose **%v{ans5}**.

15) Assistment #339291 "339291 - 6.EE.5 - Solution to Inequalities - Greater than 5"

What value of x makes the inequality shown below true?

%v{num1}x + %v{num2} > %v{num3}x +%v{num4}

Check all that apply.

Check all that apply:

✘ %v{ans}

✓ %v{ans2}

✓ %v{ans3}

✘ %v{ans4}

✘ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} + %v{num2} > %v{num3}*%v{ans2} + %v{num4}

%v{num1*ans2} + %v{num2} > %v{num3*ans2} + %v{num4}

%v{num1*ans2+num2} > %v{num3*ans2+num4}

Is this true?

Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2} > %v{num3}*%v{ans2} + %v{num4}

%v{num1*ans2} + %v{num2} > %v{num3*ans2} + %v{num4}

%v{num1*ans2+num2} > %v{num3*ans2+num4}

This is the correct solution. Choose **%v{ans2}**.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2} > %v{num3}*%v{ans3} + %v{num4}

%v{num1*ans3} + %v{num2} > %v{num3*ans3} + %v{num4}

%v{num1*ans3+num2} > %v{num3*ans3+num4}

This is the correct solution. Choose **%v{ans3}**.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2} > %v{num3}*%v{ans} + %v{num4}

%v{num1*ans} + %v{num2} > %v{num3*ans} + %v{num4}

%v{num1*ans+num2} > %v{num3*ans+num4}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2} > %v{num3}*%v{ans4} + %v{num4}

%v{num1*ans4} + %v{num2} > %v{num3*ans4} + %v{num4}

%v{num1*ans4+num2} > %v{num3*ans4+num4}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2} > %v{num3}*%v{ans5} + %v{num4}

%v{num1*ans5} + %v{num2} > %v{num3*ans5} + %v{num4}

%v{num1*ans5+num2} > %v{num3*ans5+num4}

This is wrong.

---

16) Assistment #339202 "339202 - 6.EE.5 - Solution to Equation 6"

What value of x makes the equation shown below true?

%v{num1}x + %v{num2}x + %v{num3} = %v{num4}

Multiple choice:

✓ %v{ans}

✗ %v{ans2}

✗ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the equation is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} + %v{num2}*%v{ans2} + %v{num3} = %v{num4}

%v{num1*ans2} + %v{num2*ans2} + %v{num3} = %v{num4}

%v{num1*ans2+num2*ans2+num3} = %v{num4}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2}*%v{ans2} + %v{num3} = %v{num4}

%v{num1*ans2} + %v{num2*ans2} +%v{num3} = %v{num4}

%v{num1*ans2+num2*ans2+num3} = %v{num4}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2}*%v{ans3} + %v{num3} = %v{num4}

%v{num1*ans3} + %v{num2*ans3} + %v{num3} = %v{num4}

%v{num1*ans3+num2*ans3+num3} = %v{num4}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2}*%v{ans} + %v{num3} = %v{num4}

%v{num1*ans} + %v{num2*ans} + %v{num3} = %v{num4}

%v{num1*ans+num2*ans+num3} = %v{num4}

This is the correct solution. Choose **%v{ans}**.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2}*%v{ans4} + %v{num3} = %v{num4}

%v{num1*ans4} + %v{num2*ans4} + %v{num3} = %v{num4}

%v{num1*ans4+num2*ans4+num3} = %v{num4}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2}*%v{ans5} + %v{num3} = %v{num4}

%v{num1*ans5} + %v{num2*ans5} + %v{num3} = %v{num4}

%v{num1*ans5+num2*ans5+num3} = %v{num4}

This is wrong.

---

17) Assistment #339322 "339322 - 6.EE.5 - Solution to Inequalities - Less than 6"

What value of x makes the inequality shown below true?

%v{num1}x + %v{num2}x + %v{num3} < %v{num4}

Check all that apply.

Check all that apply:

✘ %v{ans}

✘ %v{ans2}

✘ %v{ans3}

✓ %v{ans4}

✓ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} + %v{num2}*%v{ans2} + %v{num3} < %v{num4}

%v{num1*ans2} + %v{num2*ans2} + %v{num3} < %v{num4}

%v{num1*ans2+num2*ans2+num3} < %v{num4}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2}*%v{ans2} + %v{num3} < %v{num4}

%v{num1*ans2} + %v{num2*ans2} +%v{num3} < %v{num4}

%v{num1*ans2+num2*ans2+num3} < %v{num4}

This is wrong.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2}*%v{ans3} + %v{num3} < %v{num4}

%v{num1*ans3} + %v{num2*ans3} + %v{num3} < %v{num4}

%v{num1*ans3+num2*ans3+num3} < %v{num4}

This is wrong.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2}*%v{ans} + %v{num3} < %v{num4}

%v{num1*ans} + %v{num2*ans} + %v{num3} < %v{num4}

%v{num1*ans+num2*ans+num3} < %v{num4}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2}*%v{ans4} + %v{num3} < %v{num4}

%v{num1*ans4} + %v{num2*ans4} + %v{num3} < %v{num4}

%v{num1*ans4+num2*ans4+num3} < %v{num4}

This is the correct solution. Choose **%v{ans4}**.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2}*%v{ans5} + %v{num3} < %v{num4}

%v{num1*ans5} + %v{num2*ans5} + %v{num3} < %v{num4}

%v{num1*ans5+num2*ans5+num3} < %v{num4}

This is the correct solution. Choose **%v{ans5}**.

---

18) Assistment #339360 "339360 - 6.EE.5 - Solution to Inequalities - Greater than 6"

What value of x makes the inequality shown below true?

%v{num1}x + %v{num2}x + %v{num3} > %v{num4}

Check all that apply.

Check all that apply:

✗ %v{ans}

✓ %v{ans2}

✓ %v{ans3}

✗ %v{ans4}

✗ %v{ans5}

Hints:

- Replace x with all the solutions provided and see if the inequality is true.
- Suppose we replace x with %v{ans2}.

%v{num1}*%v{ans2} + %v{num2}*%v{ans2} + %v{num3} > %v{num4}

%v{num1*ans2} + %v{num2*ans2} + %v{num3} > %v{num4}

%v{num1*ans2+num2*ans2+num3} > %v{num4}

Is this true?
Repeat the same procedure replacing x with %v{ans3}, %v{ans}, %v{ans4} and %v{ans5}.

- Replacing x with %v{ans2}

%v{num1}*%v{ans2} + %v{num2}*%v{ans2} + %v{num3} > %v{num4}

%v{num1*ans2} + %v{num2*ans2} +%v{num3} > %v{num4}

%v{num1*ans2+num2*ans2+num3} > %v{num4}

This is the correct solution. Choose **%v{ans2}**.

Replacing x with %v{ans3}

%v{num1}*%v{ans3} + %v{num2}*%v{ans3} + %v{num3} > %v{num4}

%v{num1*ans3} + %v{num2*ans3} + %v{num3} > %v{num4}

%v{num1*ans3+num2*ans3+num3} > %v{num4}

This is the correct solution. Choose **%v{ans3}**.

Replacing x with %v{ans}

%v{num1}*%v{ans} + %v{num2}*%v{ans} + %v{num3} > %v{num4}

%v{num1*ans} + %v{num2*ans} + %v{num3} > %v{num4}

%v{num1*ans+num2*ans+num3} > %v{num4}

This is wrong.

Replacing x with %v{ans4}

%v{num1}*%v{ans4} + %v{num2}*%v{ans4} + %v{num3} > %v{num4}

%v{num1*ans4} + %v{num2*ans4} + %v{num3} > %v{num4}

%v{num1*ans4+num2*ans4+num3} > %v{num4}

This is wrong.

Replacing x with %v{ans5}

%v{num1}*%v{ans5} + %v{num2}*%v{ans5} + %v{num3} > %v{num4}

%v{num1*ans5} + %v{num2*ans5} + %v{num3} > %v{num4}

%v{num1*ans5+num2*ans5+num3} > %v{num4}

This is wrong.

Skill	Class
Write Expressions for Real World Situations	6.EE.6

1) Assistment #365174 "365174 - 6.EE.6 - No 1"

Use the picture below to answer this question.

Fall Carnival

Admission $%v{a}

Each ride $%v{e}

Which of the following expressions represents the total cost, in dollars, of 1 admission and r rides, for any number of rides?

Multiple choice:

✓ %v{a} + %v{e}r

✗ %v{a}(r + %v{e})

✗ %v{e} + %v{a}r

✗ %v{a} + %v{e} + r

✗ %v{e}(r + %v{a})

Hints:

- Remember that:
Total cost of 1 admission and r rides = Total cost of 1 admission + Total cost of r rides.

- We know the total cost of 1 admission is $%v{a}.

- We also know the cost for each rides is $%v{e}.

If you choose to go on 3 rides, the total cost for 3 rides is 3*%v{e}.

Similarly, the total cost for r rides is r*%v{e} or %v{e}r.

- Therefore, the total cost of 1 admission and r rides = %v{a} + %v{e}r.
Choose %v{a} + %v{e}r.

---

2) Assistment #331356 "331356 - 6.EE.6 - No 2"

Use the picture below to answer this question.

Canoe Rental

$%v{a} plus $%v{e}/hr

Marion wants to rent a canoe to go out on a lake. The cost is $%v{a} plus $%v{e} for each hour.

Let n be the number of hours the canoe is rented.

Using numbers, symbols, and the variable *n*, write an expression for how much it would cost to rent the canoe for *n* hours.

Algebra:

✓ %v{a} + %v{e}n

Hints:

- Remember that:
Total cost = Basic cost + Cost for n hours

- We know the Basic cost is $%v{a}

- We also know the cost for each hour is $%v{e}.

If you choose to go on 3 hours, the cost for 3 hours is 3*%v{e}.

Similarly, the Cost for n hours is n*%v{e} or %v{e}n.

- Therefore, the Total cost = %v{a} + %v{e}n.
Type in %v{a} + %v{e}n.

---

3) Assistment #365177 "365177 - 6.EE.6 - No 3"

The poster below shows the costs at a Six Flags tour.

Six Flags
Admission $%v{a}
Each ride $%v{e}

Which of the following expressions represents the total cost, in dollars, of 1 admission and r rides, for any number of rides?

Multiple choice:

✓ %v{a} + %v{e}r

- %v{a}(r + %v{e})
- %v{e} + %v{a}r
- %v{a} + %v{e} + r
- %v{e}(r + %v{a})

Hints:

- Remember that:
Total cost of 1 admission and r rides = Total cost of 1 admission + Total cost of r rides.
- We know the total cost of 1 admission is $%v{a}.
- We also know the cost for each rides is $%v{e}.

If you choose to go on 3 rides, the total cost for 3 rides is 3*%v{e}.

Similarly, the total cost for r rides is r*%v{e} or %v{e}r.

- Therefore, the total cost of 1 admission and r rides = %v{a} + %v{e}r.
Choose %v{a} + %v{e}r.

---

4) Assistment #365179 "365179 - 6.EE.6 - No 4"

The poster below shows the costs at a fishing trip.

Fishing
Admission $%v{a}
Each hour $%v{e}

Which of the following expressions represents the total cost, in dollars, of 1 admission and r hours, for any number of hours?

Algebra:

✓ %v{a} + %v{e}r

Hints:

- Remember that:
Total cost of 1 admission and r hours = Total cost of 1 admission + Total cost of r hours.

- We know the total cost of 1 admission is $%v{a}.

- We also know the cost for each hour is $%v{e}.

If you choose to go on 3 rides, the total cost for 3 hours is 3*%v{e}.

Similarly, the total cost for r hours is r*%v{e} or %v{e}r.

- Therefore, the total cost of 1 admission and r hours = %v{a} + %v{e}r.
Choose %v{a} + %v{e}r.

---

5) Assistment #333613 "333613 - 6.EE.6 - No 5"

Below is the price tag for apples.

Apple
Price: $%v{e} each

Bob went to the supermarket with $%v{a} dollars in cash to buy some apples.
Using numbers, symbols, and the variable *n*, write an expression for how much money he has

after he bought n apples.

Multiple choice:

✓ %v{a} - %v{e}n

✗ %v{a} + %v{e}n

✗ %v{e}n - %v{a}

✗ %v{a} - %v{e} + n

✗ %v{e} + %v{a}n

Hints:

- Remember that:
New budget = Original budget - Cost for n apples
- We know the Original budget is $%v{a}
- We also know the cost for each apple is $%v{e}.

If he chooses to buy 3 apples, the cost for 3 apples is 3*%v{e}.

Similarly, the Cost for n apples is n*%v{e} or %v{e}n.

- Therefore, the New budget = %v{a} - %v{e}n.

Type in %v{a} - %v{e}n.

---

6) Assistment #334398 "334398 - 6.EE.6 - No 6"

Below is the price tag for Oranges.

Orange

Price: $%v{e} each

Bob went to the supermarket with $%v{a} dollars in cash to buy some oranges.

Let n be the number of oranges Bob buys.

Using numbers, symbols, and the variable *n*, write an expression for how much money he has after he bought n oranges.

Algebra:

✓ %v{a} - %v{e}n

Hints:

- Remember that:
New budget = Original budget - Cost for n oranges

- We know the Original budget is $%v{a}

- We also know the cost for each orange is $%v{e}.

If he chooses to buy 3 oranges, the cost for 3 oranges is 3*%v{e}.

Similarly, the Cost for n oranges is n*%v{e} or %v{e}n.

- Therefore, the New budget = %v{a} - %v{e}n.
Type in %v{a} - %v{e}n.

---

7) Assistment #365181 "365181 - 6.EE.6 - No 7"

The poster below shows the price of banana and kiwi in a supermarket.

Price
Banana $%v{a}
Kiwi $%v{e}

Let p be the number of banana's purchased.

Let q be the number of kiwi's purchased.

Which of the following expressions represents the total cost, in dollars, of p bananas and q kiwis, for any number of bananas and kiwi?

Multiple choice:

✓ %v{a}p + %v{e}q

✗ %v{a}q + %v{e}p

✗ %v{a} + %v{e}p

✗ %v{a}p + %v{e}

✗ p + q

Hints:

- Remember that:
Total cost = Total cost of p bananans + Total cost of q kiwis.

- We know the cost for each banana is $%v{e}.

If you choose 3 bananas , the total cost for 3 bananas is 3*%v{e}.

Similarly, the total cost for p bananas is p*%v{e} or %v{e}p.

- We also know the cost for each kiwi is $%v{e}.

If you choose 3 kiwis, the total cost for 3 kiwis is 3*%v{e}.

Similarly, the total cost for q kiwis is q*%v{e} or %v{e}q.

- Therefore, the total cost = %v{a}p + %v{e}q.

Choose %v{a}p + %v{e}q.

---

8) Assistment #365183 "365183 - 6.EE.6 - No 8"

The poster below shows the price of banana and kiwi in a supermarket.

Price
Banana $%v{a}
Kiwi $%v{e}

Let p be the number of banana's purchased.

Let q be the number of kiwi's purchased.

Type in the total cost, in dollars, of p bananas and q kiwis, for any number of p and q?

Algebra:

✓ %v{a}p + %v{e}q

Hints:

- Remember that:

Total cost = Total cost of p bananans + Total cost of q kiwis.

- We know the cost for each banana is $%v{e}.

If you choose 3 bananas , the total cost for 3 bananas is 3*%v{e}.

Similarly, the total cost for p bananas is p*%v{e} or %v{e}p.

- We also know the cost for each kiwi is $%v{e}.

If you choose 3 kiwis, the total cost for 3 kiwis is 3*%v{e}.

Similarly, the total cost for q kiwis is q*%v{e} or %v{e}q.

- Therefore, the total cost = %v{a}p + %v{e}q.

Type in %v{a}p + %v{e}q.

---

9) Assistment #334401 "334401 - 6.EE.6 - No 9"

Bob makes %v{a} cookies and he wants to give them to a group of kids.

Let n be the number of kids in the group.

Using numbers, symbols, and the variable *n*, write an expression for how many cookies each kid receives.

Multiple choice:

✓ %v{a}/n

✗ %v{a} + n

✗ n/%v{a}

✗ %v{a}n

✗ %v{a} - n

Hints:

- Remember that the cookies is divided equally for all the kids.
- If there are 5 kids in the group, each kid would receive %v{a}/5 = %v{a/5} cookies.

Similarly, if there are n kids in the group, each kid would receive %v{a}/n cookies.

Choose %v{a}/n

---

10) Assistment #334402 "334402 - 6.EE.6 - No 10"

Bob makes %v{a} cookies and he wants to give it to a group of kids.

Let n be the number of kids in the group.

Using numbers, symbols, and the variable *n*, write an expression for how many cookies each kid receives.

Algebra:

✓ %v{a}/n

Hints:

- Remember that the cookies is divided equally for all the kids.
- If there are 5 kids in the group, each kid would receive %v{a}/5 = %v{a/5} cookies.

Similarly, if there are n kids in the group, each kid would receive %v{a}/n cookies.

Type in %v{a}/n.

Skill	Class
Write an equation or inequality to represent a real-world problem.	6.EE.8

1) Assistment #343207 "343207 - Greater than"

%v{name1} weighs %v{ans} kg. %v{name2} weighs more than John.

Assume %v{name2}'s weight in kg is x

Select the true inequality.

Check all that apply.

Check all that apply:

✓ x > %v{ans}

✓ %v{ans} < x

✗ x < %v{ans}

✗ %v{ans} > x

✗ x ≥ %v{ans}

✗ %v{ans} ≤ x

✗ x ≤ %v{ans}

✗ %v{ans} ≥ x

Hints:

- %v{name1}'s weight = %v{ans} kg

%v{name2}'s weight = x kg

%v{name2} weighs **more than** %v{name1}.

- In other words, %v{name2}'s weight is **greater than** %v{name1}'s weight *or*

%v{name1}'s weight is **less than** %v{name2}'s weight.

- The solutions are the inequalities below:

1.%v{name2}arl's weight is **greater than** %v{name1}'s weight:
x**>**%v{ans}

2.%v{name1}'s weight is **less than** %v{name2}'s weight:
%v{ans}**<**x

---

2) Assistment #343218 "343218 - Less than"

%v{name1} is %v{ans} cm tall. %v{name2} is shorter than %v{name1}.

Assume %v{name2}'s height is x cm.

Select the true inequality.

Check all that apply.

Check all that apply:

✓ x < %v{ans}

✓ %v{ans} > x

✘ x > %v{ans}

✘ %v{ans} < x

✘ x ≥ %v{ans}

✘ %v{ans} ≤ x

✘ x ≤ %v{ans}

✘ %v{ans} ≥ x

Hints:

- %v{name1}'s height = %v{ans} cm
%v{name2}'s height = x cm
%v{name2} is **shorter** than %v{name1}.

- In other words, %v{name2}'s height is **less than** %v{name1}'s height *or*
%v{name1}'s height is **greater than** %v{name2}'s height.

- The solutions are the inequalities below:

1.%v{name2}'s height is **less than** %v{name1}'s height:
x**<**%v{ans}

2.%v{name1}'s height is **greater than** %v{name2}'s height:
%v{ans}**>**x

---

3) Assistment #343233 "343233 - Greater than 2"

%v{name1} has %v{num1} maths books, %v{num2} comic books. %v{name2} has more books than %v{name1}.

Assume the number of %v{name2}'s books is x.

Select the true inequality.

Multiple choice:

✓ x > %v{ans}

✗ x > %v{num1}

✗ x > %v{num2}

✗ x < %v{ans}

✗ x < %v{num1}

✗ x < %v{num2}

Hints:

- What's the total number of books %v{name1} has?

- Number of %v{name1}'s books = %v{num1} + %v{num2} = %v{ans}
Number of %v{name2}'s books = x
%v{name2} has **more** books than %v{name1}. In other words, number of %v{name2}'s books is **greater than** number of %v{name1}'s books.

- The solution is the inequality below:

Number of %v{name2}'s books is **greater than** number of %v{name1}'s books:
x**>**%v{ans}

---

4) Assistment #343234 "343234 - Greater than 3"

%v{name1} has %v{num1} black pens, %v{num2} blue pens. %v{name2} has fewer pens than %v{name1}.

Assume the number of %v{name2}'s pens is x.

Select the true inequality.

Multiple choice:

✓ %v{ans} > x

✗ %v{num1} > x

✗ %v{num2} > x

✗ %v{ans} < x

✗ %v{num1} < x

✗ %v{num2} < x

Hints:

- What's the total number of pens %v{name1} has?

- Number of %v{name1}'s pens = %v{num1} + %v{num2} = %v{ans}
Number of %v{name2}'s pens = x
%v{name2} has **fewer pens** than %v{name1}. In other words, number of %v{name1}'s pens is **greater than** number of %v{name2}'s pens.

- The solution is the inequality below:

Number of %v{name1}'s pens is **greater than** number of %v{name2}'s pens:
%v{ans}>x

---

5) Assistment #343235 "343235 - Less than 2"

%v{name1} has %v{num1} dogs, %v{num2} cats. %v{name2} has more pets than %v{name1}.

We know that %v{name2} has %v{num3} dogs. Assume the number of %v{name2}'s cats is x.

Select the true inequality.

Multiple choice:

✓ %v{ans} < x

✗ %v{num1+num2} < x

✗ %v{num1} < x

✗ %v{ans} > x

✗ %v{num1+num2} > x

✗ %v{num1} > x

Hints:

- What's the total number of pets %v{name1}has?
What's the total number of pets %v{name2} has?

- Number of %v{name1}'s pets = %v{num1} + %v{num2} = %v{num1+num2}
Number of %v{name2}'s pets = x +%v{num3}
%v{name2} has **more** pets than %v{name1}. In other words, number of %v{name1}'s pets is **less than** number of %v{name2}'s pets

- The solution is the inequality below:

Number of %v{name1}'s pets is **less than** number of %v{name2}'s pets:

%v{num1+num2} < x+%v{num3}

%v{ans} **<** x

6) Assistment #343237 "343237 - Less than 3"

%v{name1} has %v{num1} dogs. %v{name2} has %v{num2} cats. %v{name3} has fewer pets than both of them.

We know that %v{name3} has %v{num3} cats. Assume the number of %v{name3}'s dogs is x.

Select the true inequality.

Multiple choice:

✓ x<%v{ans}

✗ x<%v{num1}

✗ x<%v{num1+num2}

✗ x>%v{ans}

✗ x>%v{num1}

✗ x>%v{num1+num2}

Hints:

- What's the total number of pets %v{name1}has?
What's the total number of pets %v{name2} has?
What's the total number of pets %v{name3} has?

- Number of %v{name1}'s pets = %v{num1}
Number of %v{name2}'s pets = %v{num2}
Number of %v{name3}'s pets = x +%v{num3}
%v{name3} has **fewer** pets than %v{name1} and %v{name2}. In other words, number of %v{name3}'s pets is **less than** number of %v{name1}'s and %v{name2}'s pets

- The solution is the inequality below:

Number of %v{name3}'s pets is **less than** number of %v{name1}'s and %v{name2}'s pets:

x+%v{num3} < %v{num1} + %v{num2}

x+%v{num3} < %v{num1+num2}

x < %v{ans}

---

7) Assistment #346857 "346857 - No more than"

%v{name1} has %v{ans} cousins. %v{name2} has no more cousins than %v{name1}.

Assume the number of %v{name2}'s cousins is x

Select the true inequality.

Check all that apply.

Check all that apply:

✗ x > %v{ans}

✗ %v{ans} < x

✗ x < %v{ans}

✗ %v{ans} > x

✗ x ≥ %v{ans}

✗ %v{ans} ≤ x

✓ x ≤ %v{ans}

✓ %v{ans} ≥ x

Hints:

- Number of %v{name1}'s cousins = %v{ans}

Number of %v{name2}'s cousins = x

%v{name2} has **no more** cousin than %v{name1}.

- In other words, number of %v{name2}'s cousins is **less than or equal** to number of %v{name1}'s cousins *or*

number of %v{name1}'s cousins is **greater than or equal** to number of %v{name2}'s cousins.

- The solutions are the inequalities below:

1.Number of %v{name2}'s cousins is **less than or equal** to number of %v{name1}'s cousins: x≤%v{ans}

2.Number of %v{name1}'s cousins is **greater than or equal** to number of %v{name2}'s cousins: %v{ans}≥x

---

8) Assistment #346868 "346868 - At least"

%v{name1}'s candy bar %v{ans} cm long. %v{name2}'s candy bar is at least as long as %v{name1}.

Assume the length of %v{name2}'s candy bar is x

Select the true inequality.

Check all that apply.

Check all that apply:

✘ x > %v{ans}

✗ %v{ans} < x

✗ x < %v{ans}

✗ %v{ans} > x

✓ x ≥ %v{ans}

✓ %v{ans} ≤ x

✗ x ≤ %v{ans}

✗ %v{ans} ≥ x

Hints:

- Length of %v{name1}'s candy bar = %v{ans} cm

Length of %v{name2}'s candy bar = x cm

%v{name2}'s candy bar is at least as long as %v{name1}'s candy bar.

- In other words, length of %v{name2}'s candy bar is **greater than or equal** to length of %v{name1}'s candy bar *or*

length of %v{name1}'s candy bar is **less than or equal** to length of %v{name2}'s candy bar.

- The solutions are the inequalities below:

1.Length of %v{name2}'s candy bar is **greater than or equal** to length of %v{name1}'s candy bar:

x**≥**%v{ans}

2.Length of %v{name1}'s candy bar is **less than or equal** to length of %v{name2}'s candy bar:

%v{ans}**≤**x

9) Assistment #346924 "346924 - At most"

%v{name1} has %v{ans} homework problems. %v{name2} has at most twice the amount of %v{name1} homework problems.

Assume the number of %v{name2}'s homework problems is x

Select the true inequality.

Check all that apply.

Check all that apply:

✗ x ≥ %v{2*ans}

✗ %v{2*ans} ≤ x

✓ x ≤ %v{2*ans}

✓ %v{2*ans} ≥ x

✗ x ≥ %v{ans}

✗ %v{ans} ≤ x

✗ x ≤ %v{ans}

✗ %v{ans} ≥ x

Hints:

- Number of %v{name1}'s homework problems = %v{ans}

Number of %v{name2}'s homework problems = x

%v{name2} has **at most twice** the amount of %v{name1}'s homework problems.

- In other words, number of %v{name2}'s homework

problems is **less than or equal** to **two** times the number of %v{name1}'s homework problems *or*

two times the number of %v{name1}'s homework problems is **greater than or equal** to number of%v{name2}'s homework problems.

- The solutions are the inequalities below:

1.Number of %v{name2}'s homework problems is **less than or equal** to two times the number of%v{name1}'s homework problems:

x ≤ 2*%v{ans}

x ≤ %v{2*ans}

2.Two times the number of %v{name1}'s homework problems is **greater than or equal** to number of%v{name2}'s homework problems:

2*%v{ans} ≥ x

%v{2*ans} ≥ x

---

10) Assistment #347388 "347388 - At least 2"

%v{name1} bought %v{num1} balloons. %v{name2} bought at least %v{num2} more balloons than %v{name1}.

Assume the number of balloon %v{name2} bought is x

Select the true inequality.

Multiple choice:

✓ x ≥ %v{ans}

✗ x > %v{ans}

✘ x ≥ %v{num1}

✘ x > %v{num1}

Hints:

- Number of balloons %v{name1} bought = %v{num1}
Number of balloons %v{name2} bought = x

%v{name2}'s bought at least %v{num2} more balloons than %v{name1}.

- In other words, number of balloons %v{name2} bought is **greater than or equal** to number of balloons%v{name1} bought plus **%v{num2}**.

- The solution is the inequality below:

Number of balloons %v{name2} bought is **greater than or equal** to number of balloons %v{name1} bought plus **%v{num2}**:

x ≥ %v{num1} + **%v{num2}**

x ≥ %v{ans}

---

11) Assistment #346976 "346976 - Combination"

%v{name1} has %v{num1} albums. %v{name2} has %v{num2} albums. %v{name3} has at least as many albums as %v{name1} but he has less album than %v{name2}.

Assume the number of %v{name3}'s albums is x.

Select the true inequality.

Check all that apply.

Check all that apply:

✓ x ≥ %v{num1}

✓ %v{num1} ≤ x < %v{num2}

✓ %v{num2} > x

✗ x > %v{num1}

✗ %v{num2} ≥ x

✗ %v{num1} < x < %v{num2}

✗ %v{num1} ≤ x ≤ %v{num2}

Hints:

- Number of albums %v{name1} has: %v{num1}

Number of albums %v{name2} has: %v{num2}
Number of albums %v{name3} has: x

%v{name3} has **at least** as many albums as %v{name1} but he has **less** album than %v{name2}.

- In other words,

number of %v{name1}'s albums is **less than or equal to** number of %v{name3}'s albums.
%v{num1} ≤ x
number of Michael's albums is **more than** number of %v{name3}'s albums.
%v{num2} > x
number of %v{name3}'s albums is **more than or equal to** number of %v{name1}'s albums.
x ≥ %v{num1}
number of %v{name3}'s albums is **less than** number of %v{name2}'s albums.
x < %v{num2}

- Combine %v{num1} ≤ x and x < %v{num2}, we have:

%v{num1} ≤ x < %v{num2}.

The solutions are:
x ≥ %v{num1}

%v{num2} > x

%v{num1} ≤ x < %v{num2}

Appendix C – MATLAB code counting the data

1. Reading the data from Excel sheets

```
% Excel data
clear all;
filename = 'New Data Splitted Version 3.xlsx';

%% Sequene 85588 - 6EE2c
% No Hint
sheet = 3;
a1 = xlsread(filename, sheet, 'C:C');    % student_id
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'M:M');    % hint_count
a4 = xlsread(filename, sheet, 'P:P');    % bottom_hint
a4(isnan(a4)) = 0;
D1 = [a1 a2 a3 a4];
% Hint
sheet = 4;
a1 = xlsread(filename, sheet, 'C:C');    % student_id
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'M:M');    % hint_count
a4 = xlsread(filename, sheet, 'P:P');    % bottom_hint
a4(isnan(a4)) = 0;
D2 = [a1 a2 a3 a4];

%% Sequene 85161 - 6EE4
% No Hint
sheet = 5;
a1 = xlsread(filename, sheet, 'C:C');    % student_id
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'M:M');    % hint_count
a4 = xlsread(filename, sheet, 'P:P');    % bottom_hint
a4(isnan(a4)) = 0;
D3 = [a1 a2 a3 a4];
% Hint
sheet = 6;
a1 = xlsread(filename, sheet, 'C:C');    % student_id
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'M:M');    % hint_count
a4 = xlsread(filename, sheet, 'P:P');    % bottom_hint
a4(isnan(a4)) = 0;
D4 = [a1 a2 a3 a4];

%% Sequene 82699 - 6EE6
% No Hint
sheet = 7;
a1 = xlsread(filename, sheet, 'C:C');    % student_id
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'M:M');    % hint_count
```

```
a4 = xlsread(filename, sheet, 'P:P');   % bottom_hint
a4(isnan(a4)) = 0;
D5 = [a1 a2 a3 a4];
% Hint
sheet = 8;
a1 = xlsread(filename, sheet, 'C:C');   % student_id
a2 = xlsread(filename, sheet, 'K:K');   % correct
a3 = xlsread(filename, sheet, 'M:M');   % hint_count
a4 = xlsread(filename, sheet, 'P:P');   % bottom_hint
a4(isnan(a4)) = 0;
D6 = [a1 a2 a3 a4];

%% Sequene 85113 - 6EE2a
% No Hint
sheet = 9;
a1 = xlsread(filename, sheet, 'C:C');   % student_id
a2 = xlsread(filename, sheet, 'K:K');   % correct
a3 = xlsread(filename, sheet, 'M:M');   % hint_count
a4 = xlsread(filename, sheet, 'P:P');   % bottom_hint
a4(isnan(a4)) = 0;
D7 = [a1 a2 a3 a4];
% Hint
sheet = 10;
a1 = xlsread(filename, sheet, 'C:C');   % student_id
a2 = xlsread(filename, sheet, 'K:K');   % correct
a3 = xlsread(filename, sheet, 'M:M');   % hint_count
a4 = xlsread(filename, sheet, 'P:P');   % bottom_hint
a4(isnan(a4)) = 0;
D8 = [a1 a2 a3 a4];

%% Sequene 82812 - 6EE5
% No Hint
sheet = 11;
a1 = xlsread(filename, sheet, 'C:C');   % student_id
a2 = xlsread(filename, sheet, 'K:K');   % correct
a3 = xlsread(filename, sheet, 'M:M');   % hint_count
a4 = xlsread(filename, sheet, 'P:P');   % bottom_hint
a4(isnan(a4)) = 0;
D9 = [a1 a2 a3 a4];
% Hint
sheet = 12;
a1 = xlsread(filename, sheet, 'C:C');   % student_id
a2 = xlsread(filename, sheet, 'K:K');   % correct
a3 = xlsread(filename, sheet, 'M:M');   % hint_count
a4 = xlsread(filename, sheet, 'P:P');   % bottom_hint
a4(isnan(a4)) = 0;
D10 = [a1 a2 a3 a4];

%% Sequene 82813 - 6EE8
% No Hint
sheet = 13;
a1 = xlsread(filename, sheet, 'C:C');   % student_id
```

```
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'M:M');    % hint_count
a4 = xlsread(filename, sheet, 'P:P');    % bottom_hint
a4(isnan(a4)) = 0;
D11 = [a1 a2 a3 a4];
% Hint
sheet = 14;
a1 = xlsread(filename, sheet, 'C:C');    % student_id
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'M:M');    % hint_count
a4 = xlsread(filename, sheet, 'P:P');    % bottom_hint
a4(isnan(a4)) = 0;
D12 = [a1 a2 a3 a4];

%% Transfer items
sheet = 15;
a1 = xlsread(filename, sheet, 'C:C');    % student_id
a2 = xlsread(filename, sheet, 'K:K');    % correct
a3 = xlsread(filename, sheet, 'G:G');    % sequence
T = [a1 a2 a3];

%% Student id
sheet = 2;
S = xlsread(filename, sheet, 'X:X');    % student_id
```

2. Computing the data of each skill

```
function [ output ] = compute( Da, Db, S )
% Da: data w/o hint
% Db: data w/ hint
% S: student id
% output: summary

D = [Da;Db];
n = length(S);
output = zeros(n,5);

for i=1:n
    % Find the student location
    loc = find(D(:,1)==S(i));
    if isempty(loc)
        output(i,:) = [NaN NaN NaN NaN NaN];
        continue
    end
    % Condition column
    if loc(1)>length(Da)
        output(i,1) = 1;
    else
        output(i,1) = 0;
    end
    % Count column
```

```
    output(i,2) = length(loc);
    % Complte column
    temp = D(loc,2);
    if length(loc)<3
        output(i,3) = 0;
    elseif sum(temp(end-2:end))==3
        output(i,3) = 1;
    else
        output(i,3) = 0;
    end
    % Hint column
    output(i,4) = sum(D(loc,3));
    % Bottom hint column
    output(i,5) = sum(D(loc,4));
end

end

function [ output ] = transfer( T, seq, S )
% T: transfer items data
% seq: sequence number
% S: student id
% output: summary

Tcut = T(T(:,3)==seq,1:2);
n = length(S);
output = zeros(n,1);

for i=1:n
    % Find the student location
    loc = find(Tcut(:,1)==S(i));
    if isempty(loc)
        output(i) = NaN;
    else
        output(i) = Tcut(loc,2);
    end
end

end
```

3. Creating the data summary

```
Summary = [compute(D1,D2,S) transfer(T,85588,S) compute(D3,D4,S)...
    transfer(T,85161,S) compute(D5,D6,S) transfer(T,82699,S)...
    compute(D7,D8,S) transfer(T,85113,S) compute(D9,D10,S) ...
    transfer(T,82812,S) compute(D11,D12,S) transfer(T,82813,S)];
```