Electronically Aiding Students’ Learning

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Abstract:

The Assistments System was designed by Professor Neil Heffernan to help students learn. We have been enhancing the Assistments system to explore the benefits of scaffolding questions, worked examples, and explanations of individual knowledge components as a means to the main goal. Hopefully, the work we have done these past few terms will translate to more informed middle school students in the subject area of math.
Introduction:

The Massachusetts Comprehensive Assessment System, or MCAS, must be passed by all public high school students in 10th grade in order to graduate. The questions are written by a board of teachers to best represent of the curriculum frameworks designed by the Massachusetts Department of Education. This recently added requirement test students in mathematics, English language arts, science and technology, history, and social sciences. The tests are an array of multiple-choice, short-answer, and open-response questions along with essay sections in the English and language arts portion. Because of the growing concern of students not passing, Professor Neil Heffernan of Worcester Polytechnic Institute has developed a web-based tutoring program for mathematics called Assistments.

Assistments tested two different types of learning methods, hints and scaffolding. A scaffolding problem breaks a problem into smaller, more basic questions or sub-problems that break down the original problem. Each of those basic questions has its own hints guiding them in the correct direction. Hints simply gave hints a sequential order if the student requested them, eventually leading them to the final answer. The sub-problems were designed to be easy to understand for a student, using bright colors to highlight and emphasize areas of importance. Assistments enables each student to essentially receive their own tutor, because the system walks the student through each problem. It also allows the student to work at their own pace without the pressure of
other peers or being put on the spot by the teacher. Assistments are currently in circulation around Worcester. A key component which is currently of great assistance to the teachers is the knowledge component.

A knowledge component is a way to tag a problem based on the type of math required to solve the problem, for example, geometry, addition, etc. These were written by our group and can be accessed through a wikipage. Eventually, there will be a link from the assistments page to the wikipage to assist the student in that area of concern with a general definition, how it’s used, and an example. There are currently 106 knowledge components. Assigning each problem the proper knowledge component is extremely valuable for the teacher, which in turn benefits the student. At any time, the knowledge components aide teachers by allowing them to easily assess what areas need work for individual students or as a whole class. This will help teachers manage their class time and use it more efficiently, directly assessing students needs.

The purpose of this project was to first write hints or scaffolding problems from previous MCAS tests or investigation activities for the 8th grade. After which, all the knowledge components were written by our team on the wikipage.
Previous System

Currently, Assessments is in its second generation. The first generation was quite successful, but did have many bugs and problems, which were constantly being updated. The questions provided by the assistment system were recreated from previous MCAS tests. For the first system, knowledge components were not implemented to the extent of they are now. As questions were designed, the builder tagged what type of knowledge component applied, but most went untagged until after the first system was out of use. Two different types of questions were designed, scaffolding questions and hint questions. The original assistment system was not user friendly compared to the new system. The save time when writing problems took at times up to five minutes, which turned into a large amount wasted time. The MCAS question was written in the main question with an option to upload a picture. The answer section required a response type, for example multiple choice.

One downside to the 1st generation system was that each time any part of the problem was changed, the problem needed to be saved, which equated in too much time spent on save time. The save time problem was later fixed with an autosave feature which was added to the next system.

The first system was designed to determine the effectiveness of the two different type of learning strategies, hints or scaffolding. The data from the answered questions was compiled into an excel file and a method was developed to determine whether learning had occurred. This turned out to be a very tough task because it was tough to determine if the students had actually learned from the help provided. Although
knowledge components were applied to this system, they were not of great importance at the time and most questions went without being tagged to the detail that was required. Although the use of knowledge components was not prominent in the first system, the usefulness was discovered and in the later system applied much more vigorously.

Currently, the knowledge components are separated into 106 different categories based on the type of math required to solve the problem. They are organized by the different categories with the percentage of students who answered each question correctly with the question also available for viewing. The teacher can also browse by class period or student. Having all problems tagged with knowledge components to the new assistance system allows the teacher to easily identify which area the students need help in individually or as a class. The knowledge components also aides the teacher because it allows them to understand what areas they might have trouble teaching in which can allow them to improve their curriculum for the following year.
Hints:

Within the Assistment, there is a feature called hints. Once enabled, the Assistment writer is allowed to give little clues on what they question is asking. They unfold one after another until the last hint, which we usually put as the answer to the question asked.

They are pretty simple to create. A feature in the Assistment builder lets you select whether you want hints in the problem on which you are working. Once the hints are enacted, it is as simple as writing in the box, and saving. In the early system, hints were rudimentary; they gave you no special features like text fonts or colors. One would have to use html coding to implement any fancy writing.

With the new Assistment system, this was changed, to better facilitate the writers of the Assistsments. All the text features one could ask for were given on a toolbar above the hint writing space. These features ranged from text font changes, to text color, and, of course, Bold, Italic, and Underline buttons. A table feature was also added, and with it, the ability to line up text, for keeping an equation looking neat or keeping values in place. The biggest addition, however, was the image uploader. It was unthinkable up until now to put an image in a hint; with the new feature, this dream became reality. Hints became much more stylish. We could now indicate things we would want the student to see in color or Bold. We could link those colors to pictures, graphs, tables, anything our imaginations could fathom. The addition of pictures, colors to the text, and all these special features did nothing but add to the feature of the hint.
Hints were extremely useful in the old Assistment system; they were the only way to give help. As the student would do the problem, if they got the question wrong, or didn’t want to give an answer, for fear of getting it wrong, they would click “Request Help”. This would then bring the hint up in a yellow box, with a suggestion on a way of completing the problem. Hints, however, didn’t see their real glory until scaffolding questions were enacted by the Assistment system. As before, you would click on the “Request Help” button, and look at the hints to the problem. However, in the scaffolding questions, hints became a sort of special way of breaking down the problem, simply and elegantly. With each successive scaffold or worked example, the hints within them provided a step by step track, a roadmap, to solving the question. This system is a great way to convey how one can do the problem given, and though it is still utilized, its essence paved the way for the ultimate hint system: The Assistment Knowledge Components.
Scaffolding Questions:

What they are:

Scaffolding breaks down a problem into its component questions. If the problem involves knowing the Order of Operations, a Scaffolding question would first ask the student to come up with what that order would be. From there, it would ask the student knowing that, which part of the problem they should answer first.

Scaffolding questions enable an electronic version of the Socratic method of teaching. In person, the Socratic Method forces a teacher to ask questions rather than giving answers. In *The Socratic Method: Teaching by Asking instead of by Telling* Rick Garlikov describes “the Socratic method in what [he] consider[s] its purest form,” to be “where questions (and only questions) are used to arouse curiosity and at the same time serve as a logical, incremental, step-wise guide that enables students to figure out about a complex topic or issue with their own thinking and insights.” (Garlikov) Scaffolding questions do just that, asking logical, incremental questions that enable students to figure out the more complex original problem.

Students are walked through the problem, answering easier questions. This allows them to see that they've understood the information since the beginning, and teaches them what they didn't already know. Scaffolding questions force students to become involved in the information that they are learning, and
understand how individual pieces fit together, following the same philosophy of Socratic education.

**How they relate to Hints:**

Oftentimes, the students just can’t come up with the proper answers in a timely enough fashion to move the lesson along. This frustrates the students instead of exciting their curiosity and interest. At this point, a live teacher would use verbal hints to give their students more direction. Eventually, the answer would have to come from the teacher if it cannot come from the students. In a similar manner, Assistments does not force a student into endlessly answering a scaffolding question that seems impossible to the student. Assistments also provides the students with hints for each individual scaffolding question; the last of which spells the answer out for the student so that the student can move on to the next question. This mixes all the benefits of hints with the benefits of scaffolding questions. Implementing scaffolding questions compounds the benefits of hints.

Scaffolding questions do have definite advantages over hints alone, however, as proven by a study done by Leena Razzaq using the Assistments program. She discovered that students’ performance improved using scaffolding questions a significant amount more than using hints alone. This corresponded to her findings through survey that students who approached questions by trying to
get them done as quickly as possible did not do well. Scaffolding questions force the student to slow down and pay attention to what they are learning. Enforcing a slower learning process rather than a “get this done as quick as I can” process benefits the students.

Scaffolding questions force more investment than hints on the part of the student. A student can click hints, barely read them and find the answer to a question. Scaffolding questions, on the other hand, require the student to interact with what they’re learning while they’re learning it. The famous Chinese proverb applies here: “I hear and I forget. I see and I remember. I do and I understand.” At their bare minimum, hints only cover the “I hear” part. They tell the students something that will hopefully lead to them getting the answer. Oftentimes, we try to put pictures in our hints, illustrating how something works. This covers the “I see and I remember.” Scaffolding questions, on the other hand, have the students “do” something. They answer questions for themselves. Scaffolding questions help the students reach the “I do and I understand” part of the proverb, implementing centuries-old wisdom with technology.

**Scaffolding Questions Benefit to teachers:**

With computing comes the ability to keep track of more data. Assistments takes full advantage of database technology to keep track of several minute details that teachers can look at to better understand where their students are having
trouble. Using the AssiStments program enables teachers to see at a glance which problems individual students got wrong as well as which broader learning areas the greatest percentage of students in a class had trouble with. It also displays how many hints it took in each scaffolding question for a student to discover the answer. This data can be essential for teachers who want to figure out which topics they need to cover in more depth.

Because scaffolding questions are pieces of the original question, looking at how many hints it took students to figure out individual scaffolding questions pinpoints exactly where in the problem students are having trouble. On a problem about Order of operations, for example, the first scaffolding question usually asks “What is the order of operations.” If students seem to get this question right, but then struggle when implementing it, the teacher can focus on working out examples on the board, and reviewing arithmetic. If the students are having trouble with this first scaffolding question, however, the teacher knows that he or she should go back to covering exactly what the order is. This allows more effective use of class time. The teacher does not need to spend class time going over each individual piece of a problem in depth, he or she can spend depth time only on the precise location the student needs it. Scaffolding questions, combined with AssiStments power to collect, store, and sort information can be a powerful tool for teachers when planning how to use class time.
Scaffolding Questions Benefit to students:

Oftentimes, a student understands the components of the problem, but is confused when seeing everything at once. Breaking the question down builds confidence, as the students see the pieces of the question that they understand.

Scaffolding questions are also an effective review mechanism. If a student has fallen behind in a particular area, that student can use the scaffolding questions as an in depth review of the topic. The VARK Learning style model created by Fleming explores the fact that different students have different learning styles. The Kinesthetic learning style would benefit from Scaffolding questions especially. Fleming’s description of this learning style’s intake strategy is “The ideas on this page are only valuable if they sound practical, real, and relevant to you.” (Fleming) These students get the least benefit from a traditional read and lecture style, and so need the most attention they can get inside their learning style. It would also seem that a computer program built around asking questions and getting answers from reading material would similarly turn off these students, but scaffolding questions assure that this is not the case. Scaffolding questions put the material its teaching into a relevant context. The student has been asked to answer a question that he or she was unable to understand. The scaffolding questions relate directly back to that question. Kinesthetic learners who need to connect utility with what they’re learning will pay more attention, and thus learn more. Visual learners can still benefit from the pictures and pointed colors in our
scaffolding questions. Read/Write learners are reading the scaffolding questions, and their own answers, thus also benefiting from scaffolding questions. While aural learners do not benefit from the silent Assistance program, they are the most likely to have understood directly from the lectures themselves, and thus will probably bypass these scaffolding questions to begin with. Scaffolding questions appeal to almost all learning styles, making them an effective review tool.

Our implementation:

Developing scaffolding questions is an art. As a general rule, we decided each problem should be associated with three scaffolding questions. This allows the student to move through the problems at a reasonable pace, while still looking into depth at each problem.

We did not always follow this rule, however. Sometimes we would come across a question that would bring up an important point in the scaffolding questions themselves. One example of this was a problem where the student using the program was given a fraction of problems correct for each of the problem’s students. Each of these fractions should have been easily converted into recognizable percents for the student (3/4 by sixth grade should be trivial to convert to 75%). If they had gotten the problem wrong, it might have been because the fraction to percent conversion had not been recognizable. To reinforce these conversions each fraction was given its own scaffolding question.
Had the equivalence been as obvious to the student as it should have been, these would be quick questions that would not eat into the students’ time much. If the conversions weren’t quick, it was worth the student’s time to learn them. Only after these questions was the comparison mentioned. The goal of these scaffolding questions became not only to help the student answer the original problem, but to fix a gap in their knowledge, making it worth the students time to answer more than 3 scaffolding questions.

On the other hand, we would occasionally run into a problem where while the idea behind the original problem was important, less than three scaffolding questions would more than cover the topic. One example includes a problem asking how a made-up student could check her answer to a subtraction problem. The answer the MCAS had been looking for was to check your answer against the reverse operation, using fact families. This is a useful thing for a student to know; even the brightest students make mistakes, and knowing the tricks to catch them could change a student’s grade or MCAS score. To slowly egg the answer out of a student in three scaffolding questions, however, would drag the student’s time out unnecessarily. We would prefer them spend time on the question described in the previous paragraph. Because of this, we gave the students only one scaffolding question to answer- a similar question using easier numbers where the relations between numbers became more obvious. Three scaffolding questions per problem made for a nice rule, but only when it didn’t interfere with assuring the students’ spent their time productively.
We have a similar rule for hints per scaffolding question. Our hints start out broad and move until we actually give the students the answer. This circumvents the problem of students getting stuck on one portion, while not immediately giving them an answer when all they want is a hint. See the discussion under scaffolding questions: connection to hints.

The very last scaffolding question in every group restates the initial problem. The hints on this scaffolding question often referred back to the connection between the scaffolding questions they had already been answering to this question, further cementing the ideas into the student’s head. This rounds out the scaffolding questions, reminding the students why they had learned the previous material. The scaffolding questions should have hit upon the trouble the student had with the initial problem. Reiterating that problem gives the student a second chance at it, understanding more of the information. Discovering that they now understand the question builds the students’ confidence in their newly found knowledge.

To encourage this confidence, we try not to answer the entire question for the student in the scaffolding questions. A question on order of operations, for example, might ask what the order of operations are, and follow it up with a question asking about the first step of the initial problem. We would not, however, continue in that vein until the problem is completely solved. This allows students to continue applying their knowledge to actually solving the problems for
themselves. This builds confidence. It also assures that the student is not merely copying what we’ve given them but applying it.

**Hints for development:**

In order for the scaffolding questions to work, they need to keep the students’ attention. The explanations in the hints must be short and understandable enough that even students whose first language isn’t English can follow it. Using colors for certain ideas aid in the ease of following explanations. Pictures illustrate an idea, rather than writing it out in a complicated manner. Keeping individual lines short keeps the students’ eyes moving across the page, soaking in the details of individual lines rather than the entire page. We make sure the style of each individual assistment eases the students’ learning ability, rather than frustrating them.

**How the Builder Works:**

A teacher who wants to build an assistment logs on to Assistments, and clicks build. They then click “Create new Assistment”. From there, they write the original problem and save it. If they want hints and only hints, they enable hints. If they want scaffolding, they enable scaffolding. Only one or the other will work for each individual question. They can then click the type of problem: fill in, algebra (where \( \frac{3}{4} \) is the same as 0.75), or multiple choice. After this, they enter in the proper answer, and mark it as correct. Any incorrect answers they plug in can
have “buggy messages” explaining what went wrong. For this first question, however, buggy messages are not necessary, as getting the question wrong will automatically enter the scaffolding questions if scaffolding is enabled. Each of these scaffolding questions work exactly like the original question. One can also click a trash can to delete the section they are looking at.

**Suggestions for improvement:**

**assitment developers:**

For now, the people writing “assitments” for the program attend WPI and are receiving IQP credit for doing so. We have the professor who started the program and the Reasearch Assistants and MQP students working on the software available to us to explain things, fix bugs, and aid in writing of individual problems. As the program gets less and less buggy, however, we hope to allow teachers to build their own assitments. Students are getting credit for time spent working on assitments, teachers have responsibilities to run class and grade papers and don’t have the time that students do. More teachers will be convinced to use the Assitments program the easier and faster developing problems can be. Developing for the program for the past few months have led to insights to what might make this easier for teachers.

Several questions a teacher might want to add to Assitments would be similar to each other with different numbers. These questions are called “morphs” of each other. Currently, a teacher’s best option is continual copy and pasting of
each individual scaffolding question for each problem. A form that allowed the teacher to fill out the entire problem including each scaffolding question and hints in one sweep of copy and paste would speed up this process immensely. A form that gives the teacher the option to completely copy an entire assistment with certain words or numbers replaced with words and numbers specified in a particular form would also make the teachers life easier.

When first getting used to the Assistments program, deleting more than was meant to be deleted can be easy to do, for example entire problem when all that needed to be deleted was one particular scaffolding question. People think they know what they are deleting when they hit delete. A dialog box asking “Are you sure you want to permanently delete this item” would not save people from entirely deleting a half an hours worth of work they want to keep. Having that message say exactly what you are deleting – “Are you sure you want to delete scaffolding question one or scaffolding question beginning with the first line of that scaffolding question” vs. “Are you sure you want to delete this assistment” would have be more useful messages.

This problem would not have been so vital if retrieval of deleted items was at all possible. The space this would take up on the server would be worth it. Space could be conserved if Assistments servers only saved the last delete for every user. This deletes the purposeful deletes from the server-if the teacher has moved on to a new question, he/she probably is no longer interested in than replaces it with what might have been an accidental delete.
Students using Assistments

Picture a sunny day, the first time the rain has stopped all week, and a swing set begging to be played upon. Students do not, as a general rule, want to be answering that beg, not working on math problems. The longer students have to be working on something, the less attention they will want to pay to it. Scaffolding questions take time to complete. If used to gain understanding, this is still time well spent. If the student has accidentally typed the wrong answer, however, this is not time well spent. If the student realizes their mistake on the first scaffolding question, the other two questions are not time well spent. Continually finding themselves caught answering questions that they actually understood, and knew that they understood will frustrate students, putting them into the mindset of “just get this done as quickly as possible” which we already know detriments their learning rather than the mindset of understanding. If students could return to the original question at any point during the scaffolding question process, it would eliminate time wasting questions so that the student could concentrate on the questions he or she actually has problems with.
Worked Examples:

What they are:

In a worked example, the student first sees a similar question to the one they are currently working on. They then get to see how this problem can be solved. The idea is, they will be able to understand why this method worked and how it did what it did, then be able to translate this to the problem they are working on directly.

Worked examples are based on the “cognitive load theory” suggested by J Sweller. Short term memory can only hold so much information at once. Long term memory puts together “schemas” that make one element out of several, connecting ideas, and thus can hold more. Cognitive overload occurs when too many individual things attempt to enter the short term memory at once. J. Sweller suggests that learning occurs by building schemas as early as possible, so that many concepts can be taken into the short term memory as one concept.

I used this method extensively in person when teaching middle school students robotics. Programming a their LEGO Mindstorm robots to follow a black line required a different way of thinking. As an “expert” programmer, relative to these students at least, I already had several schemas around if statements, while statements, and the usage of sensors by the time I learned the trick. As “novice” programmers, they were still developing these basic schemas. To aid them in the connection, I walked them through each step of the program, doing it myself. I
then deleted this program, and allowed the student to do it on his/her own.

Teaching them the whole thing, then having them teach it back to me, turned the multiple concepts they needed to know in order to implement the line following program into one basic schema, speeding up the learning process for these students.

Worked examples in Assistments bring this idea to a virtual environment. They keep all the information a student needs in one spot, explaining concepts in one problem that allows the students to focus their energies on the learning aspects – structures and applications of rules – rather than on individual questions.

**How they relate to Scaffolding questions:**

Scaffolding questions focused on making the problem easier for the student by breaking it down. Worked examples make the problem easier by creating a schema for it, connecting the individual broken down pieces. Scaffolding questions built the student’s confidence by showing them that they understood the material. Worked examples build confidence by trusting the student to make his/her own connections. Currently, other IQP teams are looking to see whether scaffolding questions or worked examples work better for the students. The results will be used to better aid students in learning.

The information displayed in multiple scaffolding questions are compiled to one spot in a worked example. For a developer, that is the main difference. It
is thus very easy to create a worked example problem from a previously written scaffolding question if one would so desire.

**Benefit to Students:**

Worked examples engage students in learning by forcing them to take an active approach to making connections. Rather than forcing the student to answer several questions in pieces, worked examples give students the opportunity to understand the applications of the rules. Learning these applications brings the information into long term memory quicker, speeding up the learning process.

**Our Implementation:**

Worked examples work very similarly to scaffolding questions as far as the Assistments program is concerned. If a student gets a problem wrong, or requests help, we bring up a worked example. The student must click a button saying that they have read and understood the problem before they go on to retry the problem.

When creating these worked examples, we again paid close attention to formatting so that the student was not overwhelmed with black, wordy information. We made sure to continue our use of colors and pictures and carriage returns, as this was even more important when all the information was presented at once than it previously had been.
Suggestions for improvement

As with any method of teaching, sometimes even the best worked examples were not all that a student needed. They might not have seen the connection between the worked example and their own problem, to unable to build a schema for themselves. scaffolding questions, we gave the students hints on top of the questions, even for the very last question, if they needed to be pushed along a little further. Our model for worked examples at the current moment, however, does not allow for that little extra push. I think we should include hints for the final question of a worked example the same way we include them for our scaffolding questions. This would cement the ideas we hoped to implement into all students’ heads, including those for whom the connection between the rules in the worked example and the rules in the actual question was not as obvious.

Knowledge Components:

The knowledge component system is the final realization of teaching students within the Assistance pages. Using the wiki format, which was first designed by Google, a website document writing style comparable to a cross between Microsoft word and html, we created tutorials of each component, which would be accessible through a link on relevant Assistance pages. These components use data collected from classes using the old and new Assistance system, which were compartmentalized into approximately 90 topics, called Knowledge Components.
It was our task to then take these knowledge component topics, and create these wiki pages, which would explain the topic at hand. After much discussion over a distinct format, we decided to use a simple, clear cut explanation of each topic. Included in this explanation is a definition or process to each component, as well as examples of problems the students would most likely see on an MCAS exam. The following figure is an example of what a finished page would look like from the writers prospective:

The wiki page gave us free reign on what types of interactive material we would want to use. The design we implemented was succinct yet informative, ideal for a student who would need to quickly brush up on the skill they would be using in the
Assistment problem they are working on. Teachers could also utilize this wiki page by creating their own Knowledge Components for whatever suits their class needs.

Currently the wiki page can be accessed by going to the Assistment website then clicking Teacher Support Pages/Teacher Manual link. Once here, scroll down to the bottom and click 8th grade skills. Here is a list of all the knowledge components available. Professor Heffernan’s team is currently working on installing links in the problems for the desired knowledge component pertaining to each problem. An example of a page from the students perspective can be seen in the following figure:

This will be a great way for the students to get a basic knowledge of the material with simple examples, and a definition before they try to approach the problem at hand. Having these links directly in the problems should help the students learn by gaining
knowledge on the topic that is easier to understand, and then enforcing it with the actual MCAS problem provided by the Assistment program.

Works Cited


Adam:
Old System
15774
15775
15844
15792
Teacher wiki:
Area
Combinatorics
Equilateral triangle
Fractions
Graph Shape
Integers
Least Common Multiple
Measurement Use Ruler
Number Line
Of Means Multiply
Ordering Numbers
Pythagorean Theorem
Rate with Distance and Time
Reduce Fraction
Similar Triangles
Sum of Interior Angles Triangle
Supplementary Angles
Symbolization Articulation

Andrew:
Hints only:
12375
Scaffold:
12327
25874
12347
12330
12376
12395
12358
Teacher Wiki
Stem and Leaf Plot
Mean
Median
Order of Operations
Circle Graph

Sarah:
Scaffold:
25703
Worked Examples:

Teacher wiki:

Adding Decimals
Addition
Divisibility
Equivalent Fractions Decimals Percents
Exponents
Fraction Division
Fraction Multiplication
Making Sense of Expressions and Equations
Multiplication
Multiplying Decimals
Multiplying Positive Negative Numbers
Ordering Decimals
Range
Rounding
Square Root
Subtracting Decimals
Subtraction
Surface Area
Venn Diagram
Ben's dog can eat 5 bags of dog food in 24 days and Sandy's dog can eat 8 bags of dog food in 42 days. Jill's dog eats 3 bags of dog food in 12 days. Bennet's dog eats 11 bags of dog food in 50 days which dog eats the most dog food on average?

**Answers:** (Interface Type: RADIO_BUTTON)
- Ben's Dog
- Bennett's Dog
- Jill's Dog
- Sandy's Dog

**Hint 1:**
First figure out the average amount each dog eats in 1 day because it is not easy to compare how much each dog eats right now.

**Hint 2:**
To do this, divide the amount of bags the dog eats by the number of days it takes to eat those bags.

**Hint 3:**
- Ben's Dog - 5/24 = 0.21 bags/day
- Sandy's Dog - 8/42 = 0.19 bags/day
- Jill's Dog - 3/12 = 0.25 bags/day
- Bennet's Dog - 11/50 = 0.22 bags/day

**Hint 4:**
Now determine which dog has eaten the most each day.

**Hint 5:**
Since Jill's dog has eaten .25 bags/day on average and this is larger that the amount eaten by the other dogs on average the answer is Jill's dog. Please select this answer.
A store has a sale on sox. 3 Pairs of sox for $6.90 (you can buy one pair of sox for the sale price). If you have $10, how many pairs of sox can you buy?

Answers: (Interface Type: TEXT_FIELD)

4

Hint 1:
First you should figure out how much it costs for one pair of sox.

Hint 2:
To do this, divide the cost for 3 pairs of sox by the number of pairs for the price. $6.90/3 = $2.30 for each pair of sox.

Hint 3:
Now figure out how many pairs of sox you can buy with $10 at $2.30 per pair.

Hint 4:
To do this, divide the amount of money you have by the cost for each pair of sox. $10/$2.30 dollars = 4.35 pairs

Hint 5:
Remember that pairs of sox can only be bought in whole amounts, you can't buy .35 pair of sox.

Hint 6:
You can buy 4 pairs of sox for $10. Please enter 4.

No knowledge components have been assigned

Answers: (Interface Type: ALGEBRA_FIELD)

✓ 14.4

Hint 1:
Set up a proportion to help you solve this problem.

Hint 2:
There are many ways to determine the value of $x$.

Here are two ways:

1. Find what you multiply by 5 to get 36.

\[
\frac{36}{5} = 7.2
\]

Then multiply this by 2 to get $x$.

\[
x = 7.2 \times 2
\]

\[
x = 14.4
\]

2. Cross multiply and divide by 5 to find $x$.

\[
\begin{align*}
\frac{2}{5} \times \frac{x}{36} & \quad \rightarrow \quad 5 \times x = 2 \times 36 \\
5 \times x & \quad \rightarrow \quad \frac{5(x)}{5} = \frac{72}{5}
\end{align*}
\]

\[
x = 14.4
\]

false

Hint 3: It will cost 14.40 dollars for 36 apples. Please enter 14.4
Which proportion can be used to calculate $x$?

**Answers:**

- **A**: $\frac{x}{15} = \frac{3}{4}$
- **B**: $\frac{15}{4} = \frac{3}{x}$
- **C**: $\frac{x}{3} = \frac{19}{4}$
- **D**: $\frac{x}{19} = \frac{4}{3}$

**Hint 1:**

The red sides correspond and the two different colored green sides correspond.

**Hint 2:**

Now, set up a proportion to relate the similar triangles.

**Hint 3:**

- **Big Red Triangle Side** = **Big Green Triangle Side**
- **Small Red Triangle Side** = **Small Green Triangle Side**

Remember the whole leg is 19.

**Hint 4:**
\[
\frac{x}{3} = \frac{19}{4}
\]

**Hint 5:**
The correct answer is C. Please select C.
Assistment

You are previewing content.
There are 11 teachers and 132 students at a middle school.
What is the ratio of teachers to students?

Comment on this question
A ratio is a comparison of two numbers. We are comparing the number of teachers to the number of students.

Comment on this hint
The ratio of teachers to students is 11 to 132, but this is not the simplest form.
Since 11 and 132 share a common factor, you should reduce the ratio to its simplest form.

Comment on this hint
11 and 132 share a common factor: 11. Divide both numbers by 11 to get the simplest form.

Comment on this hint
11/11 = 1
132/11 = 12

Comment on this hint
The simplest form of the ratio is 1 to 12. Choose B.

Select one:

- C. A. 1 to 11
- C. B. 1 to 12
- C. C. 11 to 12
- C. D. 11 to 13

Submit Answer
Correct!
You are done with this problem!
Appendix B:
Scaffolding Questions
Assistment

You are previewing content.

Which of the following best represents the location of point A on the numberline shown below?

-2  A  -1  0  1  2

A. $-2\frac{3}{4}$
B. $-2\frac{1}{4}$
C. $-1\frac{1}{2}$
D. $-1\frac{1}{4}$

Comment on this question
Request Help
Select one:

Select one:
- A
- B
- C
- D

Submit Answer

Let's move on and figure out this problem

First, let's get comfortable with the number line.

What is the value at the red dot?

-2  A  -1  0  1  2

Comment on this question
The dot on a number line is placed over the number of its value.

Comment on this hint
B is placed right over -1.

The answer is -1. Type -1

Submit Answer
Correct!

Now let's look at place on the number line that is not a whole number

What is the value of the red dot and point C?

![Number Line Diagram]

- A $1\frac{1}{2}$
- B $2\frac{1}{4}$
- C $1\frac{3}{4}$
- D $2\frac{2}{3}$

The area in blue is between 1 and 2

Note that the line is broken into fourths.
Which of the following best represents the location of point A on the numberline shown below?

A. $-2\frac{3}{4}$
B. $-2\frac{1}{4}$
C. $-1\frac{1}{2}$
D. $-1\frac{1}{4}$

The area in blue is between -2 and -1
The following picture shows where each of the fractions on the number line are.

The answer is D

\[ -1 \frac{1}{4} \]
You are previewing content.
A sea otter has over 1,000,000 hairs per square inch on its back.
Which of the following equals 1,000,000?

Select one:

- A. $10^5$
- B. $10^6$
- C. $10^7$
- D. $10^8$

Let's move on and figure out this problem

$$2^3 = 2 \times 2 \times 2$$

Exponents are a way to show how many times a number is multiplied by itself.
The example above shows 2 with an exponent of 3.
Which of the following equals 100?

You are looking for an expression that means 10 * 10

$10^2$ means $10 \times 10$

Choose C.

Select one:

- A. $10^0$
- B. $10^1$
- C. $10^2$
- D. $10^{10}$

Correct!

Good. Notice that 10 with an exponent of 2 gives you an expression with 2 zeroes at the end: 100.
Now let's try the original question again.

Which of the following equals 1,000,000?

Notice the pattern:

- \(10^1 = 10\)
- \(10^2 = 100\)
- \(10^3 = 1000\)
- \(10^4 = 10,000\)

1,000,000 has 6 zeroes so the answer should have an exponent of 6

Choose B

Select one:

- A. \(10^5\)
- B. \(10^6\)
- C. \(10^7\)
- D. \(10^8\)

Submit Answer

Correct!

You are done with this problem!
Assistment

You are previewing content.
MS. Patterson divided the students in her class into groups of 6 for a classroom activity. There were 2 students left over. Which of the following could be the number of students in Ms. Patterson's class?

Comment on this question

Request Help

Select one:

- 11
- 20
- 36
- 45

Submit Answer

Let's move on and figure out this problem

Let's try to make sense of this situation. Let's say Ms Patterson had one group of six, with two extra students.

How many students would be in the class with one group of six and two extra people?

Comment on this question

There is one group of six students.

1*6 = 6

Now add the two extra students

Comment on this hint

The total number of students in the class with one group of six and two extras is:

1 * 6 + 2
6 + 2

Comment on this hint

The total number of students in the class with one group of six and two extras is:
The answer is 8. Type 8.

Comment on this hint
Type your answer below:

Submit Answer
Correct!

Remembering how we solved the last question:

\[ 1 \times 6 + 2 \]
\[ 6 + 2 \]
\[ 8 \]

How many students would be in the class with two groups of six and two extra people?

Comment on this question

There are two groups of six students.

\[ 2 \times 6 = 12 \]

Now add the other two students

Comment on this hint

The total number of students in two groups of six students with two extras can be solved by:

\[ 2 \times 6 + 2 \]
\[ 12 + 2 \]

Comment on this hint

The total number of students in two groups of six students with two extras can be solved by:
The answer is 14. Type 14.

Remembering how we solved the last question:

<table>
<thead>
<tr>
<th># of groups</th>
<th># of students in class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6 + 2 = 8</td>
</tr>
<tr>
<td>2</td>
<td>6 + 2 = 14</td>
</tr>
</tbody>
</table>

Use what we did above to solve the initial problem.

Ms. Patterson divided the students in her class into groups of 6 for a classroom activity. There were 2 students left over. Which of the following could be the number of students in Ms. Patterson's class?

Let's continue the table we've been creating. The first number represents the number of groups of six students.

This is what the table would look like for three groups of six students with two extra students.
# of students

# of groups

<table>
<thead>
<tr>
<th># of groups</th>
<th>Work in the class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6 + 2 = 8</td>
</tr>
<tr>
<td>2</td>
<td>6 + 2 = 14</td>
</tr>
<tr>
<td>3</td>
<td>6 + 2 = 20</td>
</tr>
</tbody>
</table>

Three groups of six students with two extra students is 20 students.

20 students is also a possible choice for the number of students in Ms. Patterson's class.

The correct answer is twenty. Select B. 20.
Assistment

You are previewing content.

Carolyn and Kim are selling Lemonade this summer.

It costs $0.10 to make each cup of lemonade.

They are going to sell each cup of lemonade for $0.25

If they sell 55 cups of lemonade, how much more money would they collect than they would spend?

Let's move on and figure out this problem

To figure out how much more money Carolyn and Kim would make than they would spend, lets first figure out how much money they would recieve from selling 55 cups of lemonade.

If Carolyn and Kim sell 55 cups of lemonade at $0.25, they collect $13.75

1 * .25 = .25
2 * .25 = .50
55 * .25 = 13.75
The correct answer is 13.75.  Type 13.75

Type your answer below (mathematical expression):

• 13.75

Submit Answer
Correct!

Of the $13.75 Carolyn and Kim collect, some of it went into making the lemonade.

How much does it cost in dollars to make 55 cups of lemonade?

It costs $0.10 to make 1 cup of lemonade at $0.10 each.

1 * .1 = .1

It costs $0.20 to make 2 cups of lemonade at $0.10 each.

1 * .10 = .10

2 * .10 = .20

It costs $5.50 to make 55 cups of lemonade at $0.10 each.

1 * .10 = 0.10

2 * .10 = 0.20

55 * .10 = 5.50

The answer is $5.50 type 5.50

Now that we have seen two main parts finished, let's look at the original problem
Carolyn and Kim are selling Lemonade this summer.  
It costs $0.10 to make each cup of lemonade.  
They are going to sell each cup of lemonade for $0.25  
If they sell 55 cups of lemonade, how much more money would they collect than they would spend?  

Comment on this question

In a problem like this you subtract the cost of making the lemonade from the earnings you recieve

If Carolyn and Kim had only made 1 cup of lemonade at a cost of $0.10 and sold it at a cost of $0.25 they would have earned $0.15

$$1 \times 0.25 - 1 \times 0.10 = 0.15$$

Comment on this hint

If Carolyn and Kim had only made 2 cups of lemonade at a cost of $0.10 and sold it at a cost of $0.25 they would have earned $0.30

$$1 \times 0.25 - 1 \times 0.10 = 0.15$$
$$2 \times 0.25 - 2 \times 0.10 = 0.30$$

Comment on this hint

If Carolyn and Kim made 55 cups of lemonade at a cost of $0.10 and sold it at a cost of $0.25 they would have earned $8.25

$$1 \times 0.25 - 1 \times 0.10 = 0.15$$
$$2 \times 0.25 - 2 \times 0.10 = 0.30$$
$$55 \times 0.25 - 55 \times 0.10 = 8.25$$

The answer is $8.25. Type in 8.25

Comment on this hint

Type your answer below (mathematical expression):
• 8.25

Submit Answer
Correct!
You are done with this problem!

Comment on this problem
You are previewing content.

Each jar contains an equal number of coins.

The total number of coins in 6 of the 8 jars is 54. How many coins are in all 8 jars?

To find how many coins there are total, we first must find how many coins there should be in the two remaining jars. Let’s start by finding how many coins are in one jar.

6 jars contain 54 coins. That means that in 6 jars, there are 54 coins.

To find how many coins there should be in each jar, you must divide the number of coins by the number of jars.

$54 / 6 = 9$ coins in one jar. Type in 9.

Let's move on and figure out this problem:

To find how many coins there are total, we first must find how many coins there should be in the two remaining jars. Let’s start by finding how many coins are in one jar.

How many coins should there be in the one jar?

The problem tells us that all the jars have the same number of coins in each one.

To find how many coins there should be in each jar, you must divide the number of coins by the number of jars.

$54 / 6 = 9$ coins in one jar. Type in 9.
Now that we found how many coins are in each jar, we can find how many coins are in the two remaining jars.

How many coins are in the two remaining jars?

We have 2 jars, so you have to multiply the number of coins in one jar number by 2.

9 * 2 = 18  Type in 18

Type your answer below (mathematical expression):

- 18

Submit Answer
Correct!

Now let's return to the original problem.

How many coins are in all 8 jars?

There are 54 coins in 6 jars.

We found that there are 18 coins in the two remaining jars.

Now we add the number of coins in 2 jars to the number of coins in 6 jars.

\[
\begin{array}{c}
1 \\
54 \\
\underline{+ 18} \\
72
\end{array}
\]

Enter 72
Comment on this hint

*Type your answer below (mathematical expression):*

- 72

Submit Answer
Correct!
You are done with this problem!

Comment on this problem
You are previewing content.

On Kelly's homework, the answer to the following problem shown below was marked wrong

178 - 59 = 129

Which of the following is one way for her to discover that her answer is wrong?

Select one:

- 129 - 59 = 70
- 129 + 59 = 188
- 178 + 129 = 307
- 178 + 59 = 237

Submit Answer

Let's move on and figure out this problem

Lets look at an easier version of this problem:

On John's homework, he got the following question wrong:

5 - 3 = 4

Which of the following is one way to show his answer is wrong?

Comment on this question

Consider fact families, which show the relationships between numbers.

In this case:

5 - 3 = 2
5 - 2 = 3
2 + 3 = 5
3 + 2 = 5
Notice how if you add the answer to a subtraction problem to the number you're subtracting you get the initial number.

\[ 5 - 3 = 2 \]
\[ 2 + 3 = 5 \]

If this does not happen, something is wrong.

Comment on this hint

John's problem reads

\[ 5 - 3 = 4 \]

but

\[ 4 + 3 \text{ does not equal } 5 \], it equals 7

Comment on this hint

The correct answer is that John can tell he is incorrect by realizing \( 4 + 3 = 7 \), not 5. The answer is B

Comment on this hint

Select one:

- A. \( 4 - 3 = 1 \)
- B. \( 4 + 3 = 7 \)
- C. \( 4 + 5 = 9 \)
- D. \( 5 + 3 = 8 \)

Submit Answer
Correct!

On Kelly's homework the answer to the following problem shown below was marked wrong

\[ 178 - 59 = 129 \]

Which of the following is one way for her to discover that her answer is wrong?

Comment on this question

Consider fact families, which show the relationship between numbers.

In this case:

\[ 178 - 59 = 119 \]
\[ 178 - 119 = 59 \]
\[ 59 + 119 = 178 \]
\[ 119 + 59 = 178 \]
Notice how if you add the answer to a subtraction problem to the number you're subtracting you get the initial number:

178 - 59 = 119
119 + 59 = 178

If this does not happen, something is wrong.

Kelly's problem reads

178 - 59 = 129

but

129 + 59 does not equal 178, it equals 188

the correct answer is that Kelly can tell that she is wrong by realizing that 129 + 59 = 188, not 178. the correct answer is B

Select one:

- A. 129 - 59 = 70
- B. 129 + 59 = 188
- C. 178 + 129 = 307
- D. 178 + 59 = 307

Submit Answer
Correct!
You are done with this problem!
You are previewing content.

The grid below is shaded to represent a fraction.

What fraction of the grid is shaded?

A. $\frac{1}{20}$

B. $\frac{1}{5}$

C. $\frac{1}{4}$

D. $\frac{1}{3}$

Comment on this question
Request Help
Select one:

- □ A
- □ B
- □ C
- □ D

Submit Answer

Let's move on and figure out this problem
How many times can you fit the shaded area (shown here highlighted by a red rectangle) into the rest of the square?

Look at the following picture:

Note how each red rectangle has the same number of squares as the shaded one.

There are 5 of these rectangles. The correct answer is 5.

Type your answer below:

- 5

Submit Answer
Correct!
Now let's go back to the original question.

The grid below is shaded to represent a fraction.

What fraction of the grid is shaded?

A. \( \frac{1}{20} \)

B. \( \frac{1}{5} \)

C. \( \frac{1}{4} \)

D. \( \frac{1}{3} \)

Comment on this question

Remember, we were able to break the square into five equal parts, one of which was shaded.
A fraction is a part out of a whole.

We have

\[
\frac{1 \text{ shaded area}}{5 \text{ shaded areas}} \text{ that can fit in total square}
\]

The correct answer is

B. \( \frac{1}{5} \)

click B and press submit
Comment on this hint

Select one:

- ☑ A
- ☑ B
- ☑ C
- ☑ D

Submit Answer
Correct!
You are done with this problem!

Comment on this problem
You are previewing content.

Judith has a total of 8 fish in her aquarium. Exactly 6 of the fish are guppies.

What percent of the fish in the aquarium are guppies?

Comment on this question
Request Help
Select one:
  • A. 48%
  • B. 60%
  • C. 68%
  • D. 75%

Submit Answer

Let's move on and figure out this problem

Let's first find the fraction of guppies in the fish tank compared to the total number of fish in the fish tank. Don't forget to reduce the fraction.

What fraction of the fish are guppies?

Comment on this question
There are 8 fish in all. 6 out of 8 are guppies.
Comment on this hint
6/8 of the fish are guppies. You can reduce 6/8 further.
Comment on this hint
6/8 = 3/4. Type in 3/4
Comment on this hint
Type your answer below (mathematical expression):

  • 3/4

Submit Answer
Correct!

Now use the fraction to solve the original problem.
Judith has a total of 8 fish in her aquarium. Exactly 6 of the fish are guppies.

What percent of the fish in the aquarium are guppies?

Comment on this question

1/4 is 25%. What is 3/4 as a percent?
Comment on this hint

\[ 3/4 = 1/4 + 1/4 + 1/4 = 25\% + 25\% + 25\% = ? \]

Comment on this hint

\[ 25\% + 25\% + 25\% = 75\% \]
Choose D.
Comment on this hint

Select one:

- C. A. 48%
- C. B. 60%
- C. C. 68%
- C. D. 75%

Submit Answer
Correct!
You are done with this problem!
Comment on this problem
You are previewing content.
Which of the following is closest to the product 298.7 * 10.1?

Select one:

- A. 300
- B. 2,000
- C. 3,000
- D. 20,000

Let's move on and figure out this problem
We are looking for an estimate, so that the numbers are easy to multiply.
What is the best estimate of 298.7?

Choice A: 200 and C: 250 are not the best numbers with which to estimate because they are not the closest estimations to 298.7.

Choice B: 290 is still not the best estimation to 298.7 because it is not the closest number of the choices and it is also not as "nice" a number to work with.

Choice D: 300 is the best estimation because it is the closest number to 298.7 of the choices. Choose D.

Choose the best estimate for 10.1?

Choices D: 1 can't be used because it is not close to 10.1.

Choice C: 11 is farther from 10.1 than 10.5, so it is not a good estimate.

Choice B: 10.5 is both farther from 10.1 and is not as "nice" a number as 10.
Choice A: 10 is the best estimate for 10.1 because it is the closest number to 10.1 of the choices. Choose A.

Select one:
- A. 10
- B. 10.5
- C. 11
- D. 1

Submit Answer
Correct!
Now let's look at the original problem.

Which of the following is closest to the product 298.7 * 10.1?

We estimated 298.7 to 300 and 10.1 to 10.

Now it is easy to estimate 298.7 * 10.1 by multiplying 300 * 10 instead.

To multiply 300 * 10 just add a zero to 300 making it 3000. Therefore C is the best estimate. Select C.

Select one:
- A. 300
- B. 2000
- C. 3000
- D. 30,000

Submit Answer
Correct!
You are done with this problem!
Shing made the design shown above using gray square tiles and white square tiles. What fractional part of the whole design is made up of gray tiles? Write your answer as a fraction.

Let's move on and figure out this problem.

A fraction is part of a whole. Let's count how many tiles make up the whole design.

How many square tiles make up the whole design?
First, count all of the tiles, white and grey.
There are 25 tiles in all. Type in 25

Type your answer below (mathematical expression):

• 25

Submit Answer
Correct!

Now let's count the grey tiles.

How many gray tiles are in the design?
Count the grey tiles.

There are 15 gray tiles. Type in 15

Type your answer below (mathematical expression):

- 15

Submit Answer
Correct!

Now let's try the original question.

What fractional part of the whole design is made up of gray tiles? Write your answer as a fraction.
Write your fraction like this: gray tiles/all tiles.

There are 15 gray tiles and 25 tiles in all.

Type in 15/25

You can also reduce it to 3/5

Type your answer below (mathematical expression):

- 15/25

Submit Answer
Correct!
You are done with this problem!
You are previewing content.
Which of the following shows the numbers in order from least to greatest?

Select one:

- A. 0.765, 0.82, 0.791
- B. 0.765, 0.791, 0.82
- C. 0.791, 0.82, 0.765
- D. 0.791, 0.765, 0.82

Decimal numbers are another way to write fractions or mixed numbers. For example, the number above is **four hundred seventy-nine and fifteen thousandths**.

Let's look at another example: **35.907**

What digit is in the tenths place in 35.907?
The tenths place is the first one on the right of the decimal point

Comment on this hint

The digit in the tenths place is 9. Choose C

Comment on this hint

Select one:

- C. A. 3
- C. B. 5
- C. C. 9
- C. D. 0
- C. E. 7

Submit Answer
Correct!

Let's look at the list of numbers.

Which number has the greatest value?

Comment on this question

<table>
<thead>
<tr>
<th>hundreds</th>
<th>tens</th>
<th>ones</th>
<th>tenths</th>
<th>hundredths</th>
<th>thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>7</td>
<td>0</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Line up the decimal points for the three numbers.
Compare the digits in the greatest place first.

Comment on this hint

The digits in the ones place are all the same, so compare the digits in the tenths place

Comment on this hint

8 tenths is greater than 7 tenths, so 0.82 is the greatest number.

Comment on this hint

0.82 has the greatest value. Choose A
Comment on this hint

Select one:

- A. 0.82
- B. 0.765
- C. 0.791

Submit Answer
Correct!

Okay. 0.82 has the greatest value. Now we are left with 2 numbers: 0.765 and 0.791.

Which number is greater?

Comment on this question

The ones digits and the tenths digits are the same. Compare the hundredths digits.

<table>
<thead>
<tr>
<th>hundreds</th>
<th>tens</th>
<th>ones</th>
<th>tenths</th>
<th>hundredths</th>
<th>thousandths</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>7</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Comment on this hint

The hundredths digits are 6 and 9. Which one is greater?

Comment on this hint

0.791 is greater than 0.765. Choose 0.791
Which of the following shows the numbers in order from least to greatest?

Comment on this question
0.82 is the greatest number. It should be last.

Comment on this hint
0.791 is the next greatest number. It should be in the middle.

Comment on this hint
0.765 is the smallest number. It should be first

Comment on this hint
B. 0.765, 0.791, 0.82 shows the numbers in order from least to greatest. Choose B.

Select one:
- A. 0.765, 0.82, 0.791
- B. 0.765, 0.791, 0.82
- C. 0.791, 0.82, 0.765
- D. 0.791, 0.765, 0.82

Submit Answer
Correct!
You are done with this problem!
You are previewing content.
What is the value of the following expression?

\[ 3 + 6 \times 4 \]

Comment on this question
Request Help
Type your answer below:

Submit Answer

Let's move on and figure out this problem

According to the correct order of operations, one operation should be done before the other.

Which operation must be done first?

Comment on this question
There is a certain order that you must follow to find the value of a mathematical expression.

Comment on this hint
Just follow PE(MD)(AS):

Parenthesis, Exponents, Multiplication and Division (from left to right), Addition and Subtraction (from left to right)

Comment on this hint
Take a look at the expression:

\[ 3 + 6 \times 4 \]

You see that there is multiplication and addition to do.

Comment on this hint
You must do the multiplication first. Select Multiplication.

Select one:

- ⬤ Multiplication
Great, the multiplication should be done first.

Now let's look at the original problem.

\[ 3 + 6 \times 4 \]

What is the value of the expression?

Do the multiplication first.

\[ 3 + 6 \times 4 \]

Next, add the answer you got from the multiplication to the number left in the expression.

\[ 3 + 6 \times 4 \]
\[ 3 + 24 \]

The value of the expression is 27. Type in 27

Type your answer below:

- 27

Submit Answer
Correct!
You are done with this problem!
Comment on this problem
You are previewing content.
Steve scored 1,086,000 points in a video game. Which of the following expressions below is equal to 1,086,000?

Select one:

- $100 + 80 + 6$
- $1,000 + 80 + 6$
- $1,000,000 + 80,000 + 6,000$
- $1,000,000 + 800,000 + 60,000$

Submit Answer

Let's move on and figure out this problem

What does the 1 in 1,086,000 represent?

$1,086,000$

The 1 in 1,086,000 represents the same thing as the 1 in 1,234,546 and 1,567,300

The 1 in 1,086,000 also represents the same thing as the 1 in 1,000,000

The correct answer is 1,000,000.

Select one:

- $100$
- $1,000$
- $1,000,000$

Submit Answer

Correct!

What does the 8 in 1,086,000 represent?

$1,086,000$

The 8 in 1,086,000 represents the same thing as the 8 in 85,235 and 183,000
The 8 in 1,086,000 represents the same thing as the 8 in 80,000
The correct answer is 80,000
Select one:
- $\leq 8$
- $\leq 80,000$
- $\leq 8,000,000$
Submit Answer
Correct!

What does the 6 in 1,086,000 represent?

1,086,000

The 6 in 1,086,000 means the same thing as the 6 in 6,540 and 126,300
The 6 in 1,086,000 represents the same thing as the 6 in 6,000
The answer is 6,000
Select one:
- $\leq 6$
- $\leq 60$
- $\leq 6,000$
- $\leq 60,000$
- $\leq 6,000,000$
Submit Answer
Correct!

Going back to the original problem:
Steve scored 1,086,000 points in a video game. Which of the following expressions below is equal to 1,086,000?

We know that the 1 in 1,086,000 stands for 1,000,000 We also know that the 8 stands for 80,000 and the 6 stands for 6,000. Consider what happens when you add these numbers
The answer is C.

Select one:

- A. 100 + 80 + 6
- B. 1,000 + 80 + 6
- C. 1,000,000 + 80,000 + 6,000
- D. 1,000,000 + 800,000 + 60,000

Submit Answer
You are previewing content.

What is the value of the expression shown below?

\[ 2 + 4 \times (3 + 7) \]

Comment on this question
Request Help

Type your answer below (mathematical expression):

Submit Answer

Let's move on and figure out this problem

What is the proper order of operations?

Comment on this question

A popular way to remember order of operations is to remember the acronym PEMDAS

Comment on this hint

The acronym PEMDAS means

\[ P = \text{Parenthesis} \]
\[ E = \text{Exponent} \]
\[ MD = \text{Multiplication and Division} \]
\[ AS = \text{Addition and Subtraction} \]

Comment on this hint

The correct answer is B, Parenthesis -> Exponent -> Multiplication and Division -> Addition and Subtraction

Comment on this hint

Select one:

- A. Parenthesis -> Exponent -> Addition and Subtraction -> Multiplication and Division
- B. Parenthesis -> Exponent -> Multiplication and Division -> Addition and Subtraction
- C. Multiplication and Division -> Addition and Subtraction -> Parenthesis -> Exponent
- D. Addition and Subtraction -> Multiplication and Division -> Parenthesis -> Exponent

Submit Answer
Correct!

Which of the following shows the first step of order of operations completed correctly on

2 + 4 * (3 + 7)

Comment on this question
remember PEMDAS

P = Parenthesis
E = Exponent
MD = Multiplication and Division
AS = Addition and Subtraction

Comment on this hint
P = Parenthesis

In 2 + 4 * (3 + 7) there are parenthesis to evaluate.

Comment on this hint
In 2 + 4 * (3 + 7) there are parenthesis to evaluate. This should be done first. The correct answer is C. 2 + 4 * (10)

Comment on this hint
Select one:

- C. A. 2 + 12 + 7
- C. B. 6 * ( 3 + 7)
- C. C. 2 + 4 * (10)

Submit Answer
Correct!

Now lets go back to the original problem:

What is the value of the expression shown below?

2 + 4 * (3 + 7)

Comment on this question
remember the acronym PEMDAS

P = Parenthesis
In the last question, we've already done the work in the parenthesis,

\[ 2 + 4 \times (3 + 7) \]
\[ 2 + 4 \times 10 \]

and there are no exponents, so next do the multiplication and division
and then the addition and subtraction

\[ 2 + 4 \times (10) \text{ (parenthesis)} \]
\[ 2 + 40 \text{ (Multiplication and division)} \]
\[ 42 \text{ (Addition and subtraction)} \]

The correct answer is 42. type in 42.
A baseball team won 75% of its games. If the team played 48 games, how many games did it win?

Type your answer below (mathematical expression):

•

Submit Answer

Let's move on and figure out this problem

A basketball team won 75% of its games. If the team played 56 games, how many games did they win?

Solution:

This problem involves figuring out the numerical equivalent of a percentage of something.

A few things to note:

1) "of" generally is generally a keyword for multiplication. This is true is in this case.

2) percentages can't be multiplied as a percent. In order to use multiplication on the percent, we need to convert it to a decimal

So:

By definition $75\% = \frac{75}{100} = \text{"seventy-five hundredths"} = 0.75$

$0.75 \times 56 = 42$.

The answer is 42.
Select one:

- ☑️ I have read this example and understand it and now I am ready to try again

Submit Answer
Correct!

Now try the original problem again. You may look back at the worked example if that helps you.

A baseball team won 75% of its games. If the team played 48 games, how many games did it win?

Do your best; if you cannot get the answer select hint to get the answer so you can go on.

The answer is 36.

Type your answer below (mathematical expression):

- 36

Submit Answer
Correct!
You are done with this problem!
You are previewing content.

What is the value of the expression shown below?

$$2 + 4 \times (3 + 7)$$

Submit Answer

Let's move on and figure out this problem.

Let's look at the solution to a similar problem:

What is the value of the expression shown below?

$$6 + 3 \times (2 + 6)$$

Solution to this problem:

The order of operations, often as **PEMDAS** is as follows:

- **Parenthesis**
- **Exponents**
- **Multiplication and Division**
- **Addition and Subtraction**

$6 + 3 \times (2 + 6)$  Has **parenthesis**, so, following order of operations, solve what's inside them first.

$6 + 3 \times (8)$  There are no **exponents** in this problem, so we move on to do the **multiplication and division** next.
6 + 24
Doing the last operation, addition and subtraction, we find the answer
30

The answer is 30.

What is the value of the expression shown below?
2 + 4 * (3 + 7)

2 + 4 * (3 + 7) =
2 + 4 * (10) =
2 + 40 =
42

The answer is 42. Type 42.
You are previewing content.

On Kelly's homework, the answer to the following problem shown below was marked wrong:

\[ 178 - 59 = 129 \]

Which of the following is one way for her to discover that her answer is wrong?

- A. \( 129 - 59 = 70 \)
- B. \( 129 + 59 = 188 \)
- C. \( 178 + 129 = 307 \)
- D. \( 178 + 59 = 237 \)

Let's move on and figure out this problem:

Let's look at the solution to a similar problem:

On John's homework, he got the following question wrong:

\[ 165 - 58 = 117 \]

Which of the following is one way to show his answer is wrong?

- A. \( 117 + 58 = 175 \)
- B. \( 117 - 58 = 59 \)
- C. \( 165 + 58 = 223 \)
- D. \( 165 + 117 = 282 \)

Solution to this problem:
Consider fact families, which show the relationship between numbers.

In this case:

\[
\begin{align*}
165 - 58 &= 107 \\
165 - 107 &= 58 \\
107 + 58 &= 165 \\
58 + 107 &= 165
\end{align*}
\]

First, notice how adding the answer to a subtraction problem to the number being subtracted gets the initial answer:

\[
\begin{align*}
165 - 58 &= 107 \\
107 + 58 &= 165
\end{align*}
\]

Then, realize that 117 + 58 = 175, not 165.

Using this method, John could realize his initial answer was wrong.

The answer is A.

Comment on this question

Select one:

- I have read this example and understand it and now I am ready to try again

Submit Answer
Correct!

Now try the original problem again. You may look back at the worked example if that helps you.

On Kelly's homework the answer to the following problem shown below was marked wrong

\[
178 - 59 = 129
\]

Which of the following is one way for her to discover that her answer is wrong?
Do your best; if you cannot get the answer select hint to get the answer so you can go on.

Comment on this question

129 + 59 = 188, not 178.

The correct answer is B. Click B

Comment on this hint

Select one:

- A. 129 - 59 = 70
- B. 129 + 59 = 188
- C. 178 + 129 = 307
- D. 178 + 59 = 237

Submit Answer
Correct!
You are done with this problem!
You are previewing content.

Carolyn and Kim are selling Lemonade this summer.

It costs $0.10 to make each cup of lemonade.

They are going to sell each cup of lemonade for $0.25

If they sell 55 cups of lemonade, how much more money would they collect than they would spend?

Let's move on and figure out this problem

Let's look at a similar problem being solved:

John and Andrew are holding a bakesale.

It costs $0.15 to make each cookie.

They sell each cookie for $0.50.

If they sell 30 cookies, how much more money in dollars would they collect than they would spend?

Solution to this problem:

One way to approach this problem is to take it in three steps.

1. Find out how much money John and Andrew collect selling 30 cookies.

2. Find out how much money John and Andrew spent to make 30 cookies.

3. Subtract the amount spent from the amount collected. This will show how much more the collected than spent.
Step 1: Amount collected

John and Andrew collect $0.50 for each cookie they sell. To figure out how much money they collect for 30 cookies, multiply

\[30 \times 0.50 = 15.\]

John and Andrew collect $15 for 30 cookies.

Step 2: amount spent

John and Andrew spent $0.15 to make each cookie. To find how much they spent to make 30, multiply

\[30 \times 0.15 = 4.50\]

John and Andrew spent $4.50 to make 30 cookies.

Step 3: How much more money did John and Andrew collect than they spent?

Amount Collected - Amount spent = amount more collected than spent.

\[15 - 4.50 = 11.50\]

John and Andrew collected $11.50 more than they spent. The answer is 11.50.

Comment on this question
Select one:

- 🌟 I have read this example and understand it and now I am ready to try again

Submit Answer
Correct!

Now try the original problem again. You may look back at the worked example if that helps you.

Carolyn and Kim are selling Lemonade this summer.

It costs $0.10 to make each cup of lemonade.

They are going to sell each cup of lemonade for $0.25

If they sell 55 cups of lemonade, how much more money would they collect than they would spend?
Do your best; if you cannot get the answer select hint to get the answer so you can go on.

Carolyn and Kim will collect $0.25 per cup of lemonade

\[ 0.25 \times 55 = 13.75 \]

they spent $0.10 to make each cup of lemonade

\[ 0.10 \times 55 = 5.50 \]

\[ 13.75 - 5.50 = 8.25 \]

The answer is 8.25. Type in 8.25

Comment on this hint

Type your answer below (mathematical expression):

- 8.25

Submit Answer
Correct!
You are done with this problem!

Comment on this problem
You are previewing content.

Steve scored 1,086,000 points in a video game. Which of the following expressions below is equal to 1,086,000?

Select one:

- $100 + 80 + 6$
- $1,000 + 80 + 6$
- $1,000,000 + 80,000 + 6,000$
- $1,000,000 + 800,000 + 60,000$

Let's move on and figure out this problem

Let's look at the solution to a problem similar to the one above:

Harry Potter and the Deathly Hollows sold 8,609,050 copies the day it came out. Which of the following expressions below is equal to 8,609,050?

A. $8,000 + 600 + 90 + 5$
B. $8,000,000 + 600,000 + 90,000 + 5,000$
C. $8 + 6 + 9 + 5$
D. $8,000,000 + 600,000 + 9,000 + 50$

Solution to this problem:

The 8 in $8,609,050$ is placed in the millions position and stands for 8,000,000.
The 6 in $8,609,050$ is placed in the hundred-thousands position and stands for 6,000,000.
The 9 in $8,609,050$ is placed in the thousands position and stands for 9,000.
The 5 in 8,609,050 is placed in the tens position and stands for 50.

\[8,000,000 + 6,000,000 + 9,000 + 50 = 8,609,050\]

The correct answer is D.

Comment on this question

Select one:

- I have read this example and understand it and now I am ready to try again

Submit Answer
Correct!
Steve scored 1,086,000 points in a video game. Which of the following expressions below is equal to 1,086,000?

1,086,000 = 1,000,000 + 80,000 + 6,000.

The answer is C. 1,000,000 + 80,000 + 6,000. Click C.

Comment on this hint

Select one:

- A. 100 + 80 + 6
- B. 1,000 + 80 + 6
- C. 1,000,000 + 80,000 + 6,000
- D. 1,000,000 + 800,000 + 60,000

Submit Answer
Correct!
You are done with this problem!
Appendix D: Teacher Wiki
Adding Decimals

From TeacherWiki

How its Done

When you add decimals make sure you are adding tens with tens, ones with ones, tenths with tenths and so on. To do this we line up the decimal points.

Example

1.23 + 0.54 + 17.9342

Can be written

\[
\begin{align*}
1.2300 \\
+17.9342 \\
0.5400 \\
\end{align*}
\]

From there, you can just add each of the columns, like you would in an addition problem using integers.

\[
\begin{align*}
1.2300 \\
+17.9342 \\
0.5400 \\
\hline
19.7042 \\
\end{align*}
\]

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Adding_Decimals"

- This page was last modified 05:55, 6 April 2008.
Addition

From TeacherWiki

Contents

- 1 Addition
  - 1.1 Description:
  - 1.2 Example
    - 1.2.1 $8 + (-15) + (-12) + 2$

Addition

Description:

Addition is combining numbers together. If all the numbers are positive you add them all up. If they are negative you must take them away when you add.

Example

$8 + (-15) + (-12) + 2$

Solution

$8 + (-15) + (-12) + 2$

-7 + (-12) + 2

-19 + 2

-17

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Addition"

- This page was last modified 00:58, 11 April 2008.
Area

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Finding the area

Definition

The area of a figure measures the size of the region enclosed by the figure.

This is usually expressed in terms of some square unit, such as square ft ($ft^2$).

How It’s Used

Use the area formula for that specific shape. For example,

\[ \text{square} = a^2 \]

\[ \text{rectangle} = ab \]

\[ \text{parallelogram} = bh \]

\[ \text{trapezoid} = \frac{1}{2} (b_1 + b_2) h \]

\[ \text{circle} = \pi r^2 \]

\[ \text{triangle} = \frac{1}{2} b h \]

Example

Finding the area
What is the area of the square?

![Square](image)

4

**Solution**

Using the area formula for a square, \( a^2 \), the known side is squared.

\[ 4^2 = 4 \times 4 = 16 \]

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Area"

- This page was last modified 19:35, 14 April 2008.
Combinatorics

From TeacherWiki

Contents

- 1 Definition
- 2 How Its Used
- 3 Example
  - 3.1 Number of sandwiches

Definition

This is the study of counting things.

How Its Used

Finding the total number of ways to combine items.

Note - It makes it much easier if you stay organized

Example

Number of sandwiches

Use the picture below to list all the different lunch combinations you can make.

<table>
<thead>
<tr>
<th>Entrées:</th>
<th>Drinks:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza</td>
<td>Coffee</td>
</tr>
<tr>
<td>Sandwich</td>
<td>Iced Tea</td>
</tr>
<tr>
<td></td>
<td>Soda</td>
</tr>
</tbody>
</table>

Solution

According to the picture, each entrée has one drink choice.

If only one entrée is selected, there are three different drinks to choose from which makes three different combinations to choose from. You can have pizza with coffee, pizza with iced tea, or pizza with soda.
If the other entrée is chosen then there are also another three different combinations. You can have sandwhich with coffee, sandwhich with iced tea, or sandwhich with soda.

If the different combinations are added together, there are 6 total different combinations.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Combinatorics"

- This page was last modified 02:39, 2 May 2008.
Divisibility

From TeacherWiki

Contents

- 1 Definition
- 2 Examples
  - 2.1 Find numbers that are divisible by 2
  - 2.2 Find the divisibility trick for 3
  - 2.3 Find the divisibility trick for 4
  - 2.4 Find the divisibility trick for 5
  - 2.5 Find the divisibility trick for 6
  - 2.6 Find the divisibility trick for 9
  - 2.7 Find the divisibility trick for 10

Definition

Divisibility defines what integers divide into other integers where the answer is an integer.

4 is divisible by 2 because \(4 \div 2 = 2\)

4 is not divisible by 3 because \(4 \div 3 = 1.33\)

Examples

Find numbers that are divisible by 2

All even numbers (numbers ending in 2, 4, 6, or 8) are divisible by 2

Ex: 7388 ends in 8, which is even, and so 7388 is also even

Find the divisibility trick for 3

Add the digits of a number. If the sum of the digits is is divisible by 3, so is the number

Ex:

921

\(9 + 2 + 1 = 12\).

12 is divisible by 3. Therefore, so is 921.

\(921 \div 3 = 307\)
Find the divisibility trick for 4

If the last two digits of a number are divisible by 4, so is the whole number.

Ex:
7825812
The last two digits are 12.
12 is divisible by 4.

7825812 is divisible by 4.
Also, dividing by 4 is the same as dividing by 2 twice.

Find the divisibility trick for 5

Any number ending in 0 or 5 is divisible by 5.
92370 ends in 0 and is thus divisible by 5.

Find the divisibility trick for 6

Any number that is divisible by both 2 and 3 is divisible by 6.

Ex: 132 132 ends in a 2, so it is even and therefore divisible by 2.
1 + 3 + 2 = 6, which is divisible by 3 and therefore 132 is divisible by 3.
Since it is divisible by both 2 and 3, 132 is divisible by 6.
132 ÷ 6 = 22.

Find the divisibility trick for 9

Add the digits of the number. If the sum of the digits is is divisible by 3, so is the number.

Ex:
792
7 + 9 + 2 = 18.
18 is divisible by 9. Therefore, so is 792.
792 ÷ 9 = 88

Find the divisibility trick for 10

Any number ending in 0 is divisible by 10.
43370 ends in 0 and is thus divisible by 10.


- This page was last modified 00:54, 11 April 2008.
Equilateral Triangle

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Equilateral Triangles

Definition

A triangle in which all three sides have equal lengths

How It’s Used

Used to solve for the third side of a triangle

Example

Equilateral Triangles

What are the other two angles in the triangle?
Solution

In equilateral triangles all sides are equal, therefore all angles are equal.

We know one angle already, which is 60 degrees
The other two angles in the triangle are also 60 degrees.


- This page was last modified 01:00, 4 May 2008.
Equivalent Fractions Decimals Percents

From TeacherWiki

Contents

- 1 How it is done
  - 1.1 Fraction to decimal
  - 1.2 Decimal to Percent
  - 1.3 Percent to Decimal
  - 1.4 Percent to Fraction
  - 1.5 Decimal to Fraction
- 2 Example
  - 2.1 Order the following numbers from least to greatest: 4/5 22% 0.3

How it is done

Fraction to decimal

Divide the numerator (top) by the denominator (bottom) OR

Find an equivalent fraction with 100 as the denominator and then the numerator is the percent. Write the numerator with the percent sign.

Decimal to Percent

Percent means parts out of 100. The hundredths decimal place also means parts out of 100. So, if you move the decimal point to the right two places and add a percent sign you have the equivalent percent

Percent to Decimal

Reverse of above. Move the decimal back two places and remove the percent sign.

Percent to Fraction

Percent is parts out of 100, so, write the percent as the numerator (top) of the fraction (remove the percent sign), and 100 as the denominator (bottom).

Decimal to Fraction

Consider the naming system for decimal positions: tenths, hundredths, thousandths, etc. Note that this is the same way you would name fractions. Out of 10 reads tenths, out of reads means hundredths, etc.

Example
Order the following numbers from least to greatest: \(\frac{4}{5} \ 22\% \ 0.3\)

First, put everything in the same form.

**Decimal form:**

\[
\frac{4}{5} = \frac{8}{10} = 0.8
\]

\[
22\% = \frac{22}{100} = 0.22
\]

Now, we are ordering these decimals from least to greatest

.8, .22, 0.3

0.22, 0.3, 0.8 or

22\%, .3, \frac{4}{5}

**Fraction form:**

\[
22\% = \frac{22}{100} = \frac{11}{50}
\]

\[
0.3 = \frac{3}{10}
\]

Now, we have \(\frac{4}{5}, \frac{22}{100}, \frac{3}{10}\). We need these to have the same denominator.

Let's use 50.

\[
\frac{4}{5} \times \frac{10}{10} = \frac{40}{50}
\]

\[
\frac{3}{10} \times \frac{5}{5} = \frac{15}{50}
\]

Ordered, this would now be \(\frac{11}{50}, \frac{15}{50}, \frac{40}{50}\) or \(22\%, 0.3, \frac{4}{5}\)
Percent form: \( \frac{4}{5} = \frac{80}{100} = 80\% \)

0.3 = 0.30 = 30%

So, now we’re ordering 22\%, 80\%, 30\%

Ordered, this is: 22\%, 30\%, 80\% or 22\%, 0.3, \( \frac{4}{5} \)


- This page was last modified 17:55, 11 April 2008.
Exponents

From TeacherWiki

Contents
- 1 Definition
- 2 Example
  - 2.1 23
  - 2.2 24 * 25
  - 2.3 25/23
  - 2.4 234

Definition

An Exponent shows how many times to multiply a number by itself

Example

\(2^3\)

3 is the exponent, showing how many times to multiply the 2 by itself, so

\[2^3 = 2 \times 2 \times 2\]

\(2^4 \times 2^5\)

\[2^4 \times 2^5 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 29 = 2^{4+5}\]

When a number \((x)\) brought to a exponent \((a)\) is multiplied by the same number brought to a exponent \((b)\), it equals that number brought to the first exponent plus the second exponent \((x^a \times x^b = x^{a+b})\)

\(2^5/2^3\)

\[2^5/2^3 = 2 \times 2 \times 2 \times 2 \times 2/2 \times 2 \times 2\]

Note how 3 of the 2s on top can match 3 of the twos on the bottom

\[2 \times 2 \times 2 \times 2/2 \times 2 \times 2\]

\[2^5/2^3 = 2^2 = 2^{5 - 3}\]
When a number \((x)\) brought to a exponent \((a)\) is divided by the same number brought to a exponent \((b)\), it equals that number brought to the first exponent minus the second exponent

\[(x^a + x^b = x^{a+b})\]

\[2^{34}\]

\[2^{34} = 2^3 \times 2^3 \times 2^3 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^{12} = 2^{3 \times 4}\]

When a number \((x)\) brought to a exponent \((a)\) is brought to a exponent \((b)\), it is the same as that number being brought to the first exponent multiplied by the second exponent. \((x^{a^b} = x^{a \times b})\)


- This page was last modified 02:51, 19 March 2008.
Fraction Division

From TeacherWiki

Contents

- 1 How its done
- 2 Examples
  - 2.1 2/3 ÷ 1/4
- 3 Related pages

How its done

Flip (find the Reciprocal of) the second fraction and multiply

Examples

2/3 ÷ 1/4

Flip the second fraction and change the operation \( \frac{2}{3} ÷ \frac{1}{4} \) becomes

\[
\frac{2}{3} \times \frac{4}{1}
\]

Now multiply as you would normally

\[
\frac{2}{3} \times \frac{4}{1} = \frac{8}{3}
\]

Related pages

Fraction Multiplication

Reciprocal

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Fraction_Division"

- This page was last modified 23:49, 8 April 2008.
Fraction Multiplication

From TeacherWiki

Contents
- 1 How its done
- 2 Examples
  - 2.1 What is half of five eighths?
  - 2.2 What is 75/76 * 7/100?

How its done

Multiplying Fractions gives you a new fraction.

The numerator (top) of this fraction will be product of the numerator of each of the original numerators

The denominator (bottom) of this fraction will be the product of each of the original denominators

Of is a keyword meaning multiply.

Examples

What is half of five eighths?

Of is a keyword meaning multiply.

Half of five eighths = \[\frac{1}{2} \times \frac{5}{8}\]

Multiply the numberators and the denominators

\[
\frac{1}{2} \times \frac{5}{8} = \frac{1 \times 5}{8 \times 2} = \frac{5}{16}
\]

What is 75/76 * 7/100?

This problem can be simplified before we solve it.

A number in the numerator of one fraction shares a common factor with a number in the denominator of the other.

75 \div 25 = 3
100 \div 25 = 4

So, we can take it out before multiplying the fractions.

\[ \frac{75}{76} \times \frac{7}{100} = \frac{75/25}{76} \times \frac{7}{100/25} = \frac{3}{76} \times \frac{7}{4} \]

Now, multiply the numerators with the numerators and the denominators with the denominators.

\[ \frac{3}{76} \times \frac{7}{4} = \frac{3 \times 7}{76 \times 4} = \frac{21}{304} \]

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Fraction_Multiplication"

- This page was last modified 21:11, 6 May 2008.
Fractions
From TeacherWiki

Contents
- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Understanding fractions

Definition
A way to write numbers that are not whole numbers.

How It’s Used
Fractions can be used to compare non integers, or numbers that are not whole.

Example
Understanding fractions
What is 3.4 expressed as a fraction?

Solution
To convert 3.4 to a fraction, first we must note that .4 is in the tenths place.

This can represented as \( \frac{4}{10} \).

Now we can convert the 3 to tenths as well.

Since \( \frac{10}{10} = 1 \), we know that \( \frac{30}{10} = 3 \).

Now we have \( \frac{30}{10} \), which is the same as \( \frac{3}{1} \) and \( \frac{4}{10} \), which is the same as 0.4.

Add these together \( \frac{30}{10} + \frac{4}{10} \) and you get \( \frac{34}{10} \).

3.4 can be written as a fraction as \( \frac{34}{10} \).
Note that fractions can be reduced or expanded.

For example,

34/10 can also be written as \(\frac{17}{5}\), which is also 3.4, it has just been reduced by finding a common denominator.

34 and 10 both are divisible by 2. Here 2 is the common denominator, so each number is divided by the common denominator.

\[
\frac{34}{2} = 17 \quad \text{and} \quad \frac{10}{2} = 5,
\]

thus the fraction has been reduced to \(\frac{17}{5}\) which = 3.4.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Fractions"

This page was last modified 02:56, 2 May 2008.
Graph Shape

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Graph Shape

Definition

How It’s Used

Understanding an x-y graph and interpret the data.

Example

Graph Shape

On the following graph, what is being compared?
Solution

Here distance is being compared to time.

As distance increases, so does time.

The traveler is going fastest from 9:00 to 11:30 because the line is the steepest here. The traveler covers more distance for the allotted time during this interval.

Note the flat region at 11:30 am, where the traveler stopped for a period of time before continuing.

Notice that as the y axis increases, the distance is increase.

And on the x-axis the time is increasing. The further on the x-axis you go, the larger the time value.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Graph_Shape"

- This page was last modified 02:27, 2 May 2008.
Integers

From TeacherWiki

Definition

Integers are all the whole numbers (0, 1, 2, 3, 4,...) and their opposites (-1, -2, -3, -4...).

Example

Out of the following numbers, which is not an integer?
3, -72, 23.31, -50

Solution

Since we know an integer is a whole number and the opposites of whole numbers, let’s go through the list.

3 is an integer, it is a whole number

-72 is an integer, it is the opposite of the whole number 72.

23.31 is not an integer, it contains a decimal.

-50 is an integer, it is the opposite of the whole number of 50.


- This page was last modified 02:23, 11 April 2008.
Least Common Multiple

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Understanding the Least Common Multiple

Definition

The least common multiple of two or more integers is the smallest whole number that is divisible by each of the numbers.

How It’s Used

This is very helpful when working with fractions, because the denominators should always be least common multiples in order to perform the math operation required.

There are two different methods for finding the least common multiple; one is to use the factor tree.

The other is list all the multiples of the numbers to be compared until the lowest common multiple is found.

Example

Understanding the Least Common Multiple

What is the least common denominator between 4 and 3?

Solution

First lets list all the multiples of 4, starting at 1 and going to say 7.

4, 8, 12, 16, 20, 24, 28

Now lets list all the multiples of 3, starting at 1 and also going to 7.

3, 6, 9, 12, 15, 18, 21, 24

The next step is to pick out the common multiples; here we have 12 and 24.

But we are looking for the least common multiple, so in this case it would be 12, because it is smaller than 24, making it the least common multiple.
This page was last modified 02:27, 2 May 2008.
Making Sense of Expressions and Equations

From TeacherWiki

Contents

- 1 Definition
  - 1.1 Expression
  - 1.2 Equation
- 2 Examples
  - 2.1 If 2n + 5 = 9 what does 2n - 3 equal?
  - 2.2 Fill in >, <, or = for the following problem: 1/n ___ 27/27n

Definition

Expression

Numbers, operators, grouping symbols (parenthesis or brackets), and variables grouped to have a meaning that can be evaluated.

Equation

A statement asserting the equality of two expressions, usually written as a linear array of symbols that are separated into left and right sides and joined by an equal sign.

Examples

If 2n + 5 = 9 what does 2n - 3 equal?

Solution: look at the equations

Look at how similar the expressions are:

2n +5
2n -3

The difference is between the +5 and the -3.

To find the difference means to subtract.

5 - -3 = 8(see Subtraction)

So, the value of the expression 2n - 3 is 8 less than the value of the expression 2n + 5.

You can see this on the following number line:
If \(2n + 5 = 9\), \(2n - 3 = 9 - 8 = 1\)

Or you can use algebra

\[
2n + 5 = 9 \\
2n + 5 - 8 = 9 - 8 \\
2n - 3 = 1
\]

**Solution: solving for \(n\)**

We have a full equation in \(2n + 5 = 9\); lets solve it

\[
2n + 5 = 9 \\
2n + 5 - 5 = 9 - 5 \\
2n = 4 \\
\frac{2n}{2} = \frac{4}{2} \\
n = 2.
\]

Now we can plug \(n\) into the second equation to solve it

\[
2n - 3 = 2 * 2 - 3 = 1
\]

**Fill in >, <, or = for the following problem: \(1/n \ ___ \ 27/27n\)**

**Solution: look at the equation**

We could look at the equation and see that

\[
\frac{27}{27n} = \frac{27}{27} \cdot \frac{1}{n}.
\]

Since \(\frac{27}{27} = 1\), we can see algebraically that

\[
\frac{1}{n} = \frac{27}{27n}
\]

**Solution: substituting in numbers**

substituting in 1 for \(n\) gives

\[
\frac{1}{1} = \frac{27}{27 \cdot 1} \text{ which is the same as } \frac{1}{1} = \frac{27}{27} \text{. Dividing, we find these equations are equal.} 
\]
substituting in 2 for n gives \( \frac{1}{2} \cdot \frac{27}{27 \times 2} \) which is the same as \( \frac{1}{2} \cdot \frac{27}{54} \). Dividing, we find these equations are also equal.

Now let's try substituting in 1,000 for n.

\[
\frac{1}{1 \cdot \frac{27}{27 \times 1,000}} \quad \text{which is the same as} \quad \frac{1}{1,000} \cdot \frac{27}{27,000}.
\]

We can plug this into a calculator or divide on our own and see that these are also equal.

The answer is \( \frac{1}{n} = \frac{27}{27n} \).


- This page was last modified 01:08, 11 April 2008.
Measurement Use Ruler

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Reading a ruler

Definition

How It’s Used

Use the ruler to make measurements, depending on the units, English or metric.

Metric Ruler

They deal with centimeters and millimeters only.

The larger lines with numbers are centimeters, and the smallest lines are millimeters. Millimeters are 1/10th of a centimeter, if you measure 4 marks after a centimeter, it is 1.4 centimeters long.

English Ruler

Take a look at the following English Rulers.

A ruler marked in 16ths. Every mark is 1/16th of an inch.
Below is an example.

**Example**

**Reading a ruler**

What is the reading of the red mark on the ruler?

![Ruler Image]

**Solution**

First read the inches section of the ruler, 2 inches.

Then read in, since the ruler is broken into 16ths you can count how many lines there are to the red mark.

Or since you know that the large line in-between 2 and 3 is 2 and 8/16 or 2.5 inches, you can move over one mark.

This makes the actual reading 2 and 9/16 of an inch.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Measurement_Use_Ruler"

- This page was last modified 16:20, 15 April 2008.
Multiplication

From TeacherWiki

Definition

Multiplication is repeated addition.

Examples

4 * 5 * 3

Solution 4 * 5 is the same as adding 5 to itself four times

5 + 5 + 5 + 5

or adding 4 to itself 5 times

4 + 4 + 4 + 4 + 4

4 * 5 = 20

20 * 3 is the same as adding 20 to itself 3 times.

20 + 20 + 20

or 3 20 times

3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3.

20 * 3 is 60.

This can be done in any order (4 * 5 * 3 = 3 * 5 * 4 = 5 * 4 * 3, etc.) , by a property known as the commutative property
## Multiplying Decimals

From TeacherWiki

### Contents

- 1 How its Done
  - 1.1 Method 1 – using Estimation:
  - 1.2 Method 2 – counting decimal places:
- 2 Example
  - 2.1 6.35 * 8.3

### How its Done

To multiply decimals, ignore the decimal point for initial multiplication, and multiply normally. Here are two ways to place the decimal:

**Method 1 – using Estimation:**

Estimate the product, then place the decimal so the answer has the same magnitude as the estimation.

**Method 2 – counting decimal places:**

Count the decimal places in the factors, and that will be the number of decimal places in the product.

### Example

6.35 * 8.3

**Solution using Method 1 - Estimation**

*First, just multiply as you would without decimal points.*

635 * 83 = 52705

*Now Estimate:*

6.35 is close to 6
8.3 is close to 8

Our estimate is 6 * 8 = 48

*Finally Place the decimal:*

*Where should it go*
0.52705 OR 5.2705 OR 52.705 OR 527.05

52.705 is the only choice close to 48

Therefore:
6.35 * 8.3 = 52.705.

Solution using Method 2 - counting decimal places

First, just multiply as you would without decimal points.

635 * 83 = 52705

Next, count the decimal places in the two factors 6.35 has 2 digits after the decimal point, and 8.3 has 1 digit after the decimal. So the product is 3. 6.35 * 8.3 = 52.705

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Multiplying_Decimals"

- This page was last modified 18:52, 25 March 2008.
Multiplying Positive Negative Numbers

From TeacherWiki

Contents
- 1 How Its Done
- 2 Examples
  - 2.1 -2 * 3
  - 2.2 -4 * -5
  - 2.3 -2 * -6 * -4
  - 2.4 -2 * 3 * -2

How Its Done

A positive multiplied by a positive equals a positive

A positive multiplied by a negative equals a negative

A negative multiplied by a negative equals a positive

Examples

-2 * 3

2 * 3 = 6.

The 2 is negative, and the three is positive.

A negative times a positive equals negative

-2 * 3 = -6

-4 * -5

4 * 5 = 20.

A negative times a negative equals a positive.

-4 * -5 = 20

-2 * -6 * -4

-2 * -6 = 12 (a negative times a negative equals a positive)

12 * - 4 = -48 (negative times a positive equals negative)
Note, an odd amount of negative numbers makes a negative solution

\[-2 \times 3 \times -2\]

\[-2 \times 3 = -6 \text{ (a negative times a positive is a negative)}\]

\[-6 \times -2 = 12 \text{ (a negative times a negative equals a negative)}\]

Note: an odd amount of negative numbers makes a negative answer.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Multiplying_Positive_Negative_Numbers"

- This page was last modified 00:59, 19 March 2008.
Number Line

From TeacherWiki

Definition: A line with real numbers placed in their correct position in numerical order; can be positive and/or negative.

![Number Line Image]

Example 1:

*Use a number line to find $2 - 5$.*

Start at 2 and move to the left (because you are subtracting) 5 spaces.

$2 - 5 = (-3)$.

Example 2:

*Use a number line to find $-6 + 3$.*

Start at -6 and move to the right (because you are adding) 3 spaces.

$(-6) + 3 = (-3)$.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Number_Line"

- This page was last modified 18:47, 18 March 2008.
Of Means Multiply

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example 1
  - 3.1 Of Means Multiply
- 4 Example 2

Definition

How It’s Used

Understand that, of, means to multiply. In a given problem, certain words tell you what kind of math operation you will need to do.

Below is an example.

Example 1

Of Means Multiply

What is \( \frac{3}{4} \) of 44?

Solution

Applying that of means multiply, the equation would become;

\[ \frac{3}{4} \times 44 = \]

\[ 3 \times 44 / 4 = \]

\[ 3 \times 11 = 33 \]

Example 2

Billy has $20. He gives \( \frac{1}{2} \) of his money to his mom for a game. How much does Billy have left?

Solution
Since billy gave 1/2 of his money to his mother, of means to multiply.

20 * 1/2 = 10


- This page was last modified 02:32, 2 May 2008.
Ordering Decimals

From TeacherWiki

How its done

Order decimals by their non decimal parts first. Then add zeros after the decimal until all the numbers have the same number of places after the decimal. Now put the numbers in order. Remember tenths will be greater than hundredths, etc.

Examples

Order from greatest to least: 0.3, 0.05, 0.22, 1.02

It might be helpful to rewrite the numbers so they all have two digits after the decimal point.

To ensure this, we should place a 0 after 0.3. This does not change the value of the number.

Consider this in terms of fractions:

\[ 0.3 = \frac{3}{10} \]

\[
\begin{align*}
\frac{3}{10} \times \frac{10}{10} &= \frac{30}{100} \\
0.3 &= \frac{3}{10} = \frac{30}{100} = 0.30
\end{align*}
\]

Now we have 0.30, 0.05, 0.22, 1.02.

Looking at the non decimal part first, we notice 1.02 is the greatest number

1.02 > 0.30 > 0.22 > 0.05

So the numbers ordered from greatest to least is 1.02, 0.30, 0.22, 0.05.


- This page was last modified 00:48, 11 April 2008.
Ordering Numbers

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Ordering Numbers

Definition

Arranging numbers in numerical order in order to easily assess the values for further evaluation.

How It’s Used

This is the base step in determining many properties such as range, median or mode.

Example

Ordering Numbers

Place the following numbers in order from lowest to highest.

25, 1, 5, 7, -3, 74, -53

Solution

Negative numbers are smaller than positive numbers so they come first and the negative number with the largest absolute value is the lowest because it is the farthest to the left on a number line.

Following this place the numbers in order.

-53, -3, 1, 5, 7, 25, 74


- This page was last modified 14:53, 22 April 2008.
Pythagorean theorem

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Pythagorean Theorem

Definition

In any right triangle, the area of the square whose side is the hypotenuse (the side opposite the right angle) is equal to the sum of the areas of the squares whose sides are the two legs (the two sides that meet at a right angle).

![Right Triangle Diagram](image)

How It’s Used

Used to solve for the third side of a triangle

Example

Pythagorean Theorem

What is the value of side a?
Solution  Using the Pythagorean theorem, we know that $a^2 + 4^2 = 5^2$

We can now solve for $a$;

\[ a^2 + 16 = 25 \]
\[ a^2 = 25 - 16 \]
\[ a^2 = 9 \]
\[ a = 3 \]

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Pythagorean_theorem"

- This page was last modified 17:44, 15 April 2008.
Range (Statistics)

From TeacherWiki

Contents

1 Definition
2 Examples
   2.1 Compute the range of the following list: 935, 278, 726, 465, 900
3 Related Pages

Definition

The distance between the largest and the smallest value in a set is called its range.

Examples

Compute the range of the following list: 935, 278, 726, 465, 900

Ordered from least to greatest, the list is: 278, 465, 726, 900, 935

Subtract the smallest value from the largest value: 935 - 278 = 657

The range of this data is 657.

Related Pages

Subtraction


- This page was last modified 17:57, 11 April 2008.
Rate with Distance and Time

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Rate with distance and time

Definition

How It’s Used

Breaking down the components given to determine a distance/time comparison and use this to evaluate your unknown values.

Below is an example.

Example

Rate with distance and time

Adam traveled 600 miles in 10 hours. He has another 1800 miles to his destination. How long will it take Adam to arrive at his destination if he continues along at this pace?

Solution

Adam has traveled 600 miles in 10 hours, or

600 miles/ 10 hours = 60 miles/ 1 hour

He has another 1800 miles to go at 60 miles /1 hour

1800 miles/ 60 miles/1 hour = 30 hours until he reaches his destination

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Rate_with_Distance_and_Time"

- This page was last modified 23:06, 9 April 2008.
Reduce Fraction

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Reducing a fraction

Definition

Reducing a fraction is finding an equivalent fraction in which the numbers in the numerator and denominator are smaller integers.

How It’s Used

To reduce, also known as simplifying a fraction to lowest terms, divide the numerator and denominator by their greatest common factor.

Example

Reducing a fraction

Reduce the fraction below to its lowest common denominator.

\[
\frac{25}{100}
\]

Solution

In order to start we need to find factors of 25 that are common with factors of 100.

5, and 25 are both factors of 25 and 100.

You can reduce the fraction \( \frac{25}{100} \) by 5. It will become \( \frac{5}{20} \) by dividing 25 and 100 both by the common multiple, 5.

\( \frac{5}{20} \) can then be reduced again by a common multiple of 5 which would reduce to \( \frac{1}{4} \).
If the original \( \frac{25}{100} \) was reduced by the multiple of 25 to begin with, it would have become \( \frac{1}{4} \) also.


- This page was last modified 02:52, 2 May 2008.
Rounding

From TeacherWiki

Contents

1 Definition
2 How its done
3 Examples
   3.1 Round 243.76 to the nearest ten.
   3.2 Round 243.76 to the nearest tenths
   3.3 Round 24.53\% to the nearest whole percent

Definition

Finding the number closest to a specific place value.

If the number is closer to the value higher up, we round up.

If the number is closer to the value lower down, we round down.

How its done

Examine the value above and bellow your number and determine which one is closer. If the number is exactly half way between you round up.

Examples

Round 243.76 to the nearest ten.

Solution: We’re rounding to the ten, so we know our number is between 240 and 250 (the closest numbers rounded to the tens)

240 < 243.76 < 250

240 is only 3.76 away from 243.76 so it is closest.

243.76 rounded to the nearest ten is 240.

Round 243.76 to the nearest tenths

Solution: We’re rounding to the tenths, so we know the number is between 243.70 and 243.80 (the closest numbers rounded to the tenths)

243.80 is only .04 away from 243.76, so it is closest.
243.76 rounded to the nearest tenth is 243.80.

**Round 24.53% to the nearest whole percent**

**Solution**

Saying round to the nearest whole percent is like saying round to the nearest ones.

25% is 0.47% away from 24.53% so it is closest.

24.53% rounded to the nearest whole percent is 25%

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Rounding"

- This page was last modified 18:05, 24 March 2008.
Similar Triangles

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Similar Triangles

Definition

Two triangles will have the same angles and their sides will be in the same proportion.

How It’s Used

Used to solve for the unknown sides of triangles.

Here:

angle A = angle D
angle B = angle E
angle C = angle F

AB/DE = BC/EF = AC/DF

Example
Similar Triangles

What is the length of EF?

![Diagram of similar triangles]

Solution

Since we can see that the triangles have two similar sides, we know the third must also be same.

Since $\frac{AB}{DE} = \frac{BC}{EF}$ and we know all the values besides $EF$, we can use that similarity.

$$\frac{6}{12} = \frac{7}{EF}$$

$6*EF = 7*12$

$6*EF = 84$

$EF = \frac{84}{6} = 14$

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Similar_Triangles"

- This page was last modified 17:58, 15 April 2008.
Square Root

From TeacherWiki

Contents

- 1 Definition
- 2 Example
  - 2.1 Solve
  - 2.2 Estimate

Definition

The square root of a number is the number multiplied by itself that will give you that number. (\(\sqrt{\cdot}\))

\(\sqrt{36}\) is read: "square root of 36"

Example

Solve \(\sqrt{4}\)

1 * 1 = 1
2 * 2 = 4
\(\sqrt{4} = 2\)

Estimate \(\sqrt{2}\)

To find which whole number a square root is closest too, look for a square near it. We know 1 * 1 = 1 and 2 * 2 = 4, so we know that \(\sqrt{2}\) will be somewhere between 1 and 2. 2 is closer to 1 (1 * 1) than it is to 4 (2 * 2).

\(\sqrt{2}\) will be closer to 1 than 2.

\(\sqrt{2} \approx 1.41421356\)

This is an irrational number. Many square roots are.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Square_Root"

- This page was last modified 00:51, 11 April 2008.
**Stem and Leaf Plot**

*From TeacherWiki*

**Definition**

A stem-and-leaf plot is a display that organizes data to show its shape and distribution.

In a stem-and-leaf plot each data value is split into a "stem" and a "leaf".

The "leaf" is usually the last digit of the number and the other digits to the left of the "leaf" form the "stem".

**Example**

Make a stem and leaf plot for the following data set:

33, 37, 37, 52, 56, 59, 60, 60, 78

First we create a table.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If we look at the data set, we can identify which numbers are stems, and which are leaves.

33, 37, 37, 52, 56, 59, 60, 60, 78

So the stem and leaf plot would look like this.
Don’t forget to create a legend for your plot, or a summary of how you set up your plot.

Legend: 3 | 7 means 37

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Stem_and_Leaf_Plot"

- This page was last modified 21:08, 21 April 2008.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3, 7, 7</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2, 6, 9</td>
</tr>
<tr>
<td>6</td>
<td>0, 0</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>
Subtracting Decimals

From TeacherWiki

How its done

When you add decimals make sure you are subtracting tens with tens, ones with ones, tenths with tenths and so on. To do this we line up the decimal points

Example

\[57.231 - 1.34\]

57.231 - 1.34

Can be written as

\[
\begin{array}{c}
57.231 \\
- 1.340
\end{array}
\]

From there, you can just subtract each of the columns, as you would in a subtraction problem using integers

\[
\begin{array}{c}
57.231 \\
- 1.340 \\
\hline
55.691
\end{array}
\]


- This page was last modified 23:24, 8 April 2008.
Subtraction

From TeacherWiki

Contents

- 1 Definition
- 2 How its done
- 3 Examples
  - 3.1 4 - (-2)
  - 3.2 3 - (+2)
  - 3.3 -6 - (-7)

Definition

Subtraction is finding the difference

How its done

To subtract, add the opposite.

Examples

4 - (-2)

add the opposite 4 - (-2) is the same as saying 4 + (+2) or 6

3 - (+2)

3 - (+2) is the same as 3 + (-2), or just 3 - 2 = 1.

3 + (-2) = 1

-6 - (-7)

Add the opposite -6 - (-7) = -6 + (+7) = 1.

Think of the 'difference' in height between something that is seven feet underground and something that is 6 feet underground.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Subtraction"

- This page was last modified 02:13, 15 April 2008.
Sum Of Interior Angles more than 3 Sides

From TeacherWiki

How its Done:

The sum of the angles in a triangle is 180 degrees.

SHOW IMAGE

For any polygon of more than 3 sides you can divide it into triangles.

SHOW IMAGE FOR IREGULAR HEXAGON.

Each triangle has 180 degrees so just add up the total number of 180 degrees in the Polygon.

Examples:

1. Find the measure of the interior angles of a octagon

Solution:

Start at one vertex and make triangles by connecting it to the other vertices. An Octagon will be divided into

6 triangles, as shown:

The sum of the interior angles in each of these triangles is 180.

The sum of the interior angles in all of these triangles would be 6 * 180

The sum of the interior angles in an octagon is 1080.

related links

Interior Angles of a Triangle

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Sum_Of_Interior_Angles_more_than_3_Sides"

* This page was last modified 14:10, 24 March 2008.
Supplementary Angles

From TeacherWiki

Definition: Adjacent angles forming a straight line. These angles add to 180°.

Angle a and b are supplementary.

Example: What is value of angle 1?

To evaluate this, remember that supplementary angles add to 180.

180 - 110

70

Angle 1 is 70°.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Supplementary_Angles"

- This page was last modified 19:00, 18 March 2008.
Surface Area

From TeacherWiki

Contents

1 Definition
2 How its Done
3 Examples
   3.1 Find the surface area of a cube with side length 4?
   3.2 Find the surface area of a Rectangular prism with length 7 width 4 and height 3
   3.3 Find the surface area of a cylinder with radius 6 and height 4?

Definition

The area of the shape a 3D object would make when opened up and lying flat.

How its Done

Surface Area Equations:

Cube: \(6s^2\)

Rectangle \(2 \times \text{length} \times \text{width} + 2 \times \text{width} \times \text{height} + 2 \times \text{length} \times \text{height}\)

Sphere: \(4 \times \pi \times \text{radius}^2\)

Cylinder: \(2 \times \pi \times \text{radius}^2 + 2 \times \pi \times \text{radius} \times \text{height}\)

Examples

Find the surface area of a cube with side length 4?

Solution

The surface of a cube is made up of 6 squares (see image above).

Each of those squares has an area calculated by multiplying the length of its side by itself.
So, the area of one face of this cube is $= 4 \times 4 = 16$

The Surface area of the entire cube is $6 \times$ area of one face $= 6 \times 16 = 96$.

The surface area of a cube with side length 4 is 96 square units

**Find the surface area of a Rectangular prism with length 7 width 4 and height 3**

2 of 3

![Rectangular prism diagram]

**Solution**

The surface of this rectangular prism is made up of three different sized rectangles.

Two of them are the **front** and **back**, with size 3 (the height of the prism) x 4 (the width of the prism).

They each have area **12**. $(3 \times 4 = 12)$

Two of them are the **left** and **right** sides with size 3 (the height of the prism) x 7 (the length of the prism).

They each have area **21**. $(3 \times 7 = 21)$

Two of them are the **top** and **bottom**, with size 7 (the length of the prism) x 4 (the width of the prism).

They each have area **28**. $(7 \times 4 = 28)$

To find the surface area we add the area of each of these rectangles.

$2 \times 12 + 2 \times 21 + 2 \times 28 = 122$.

The surface area of a rectangular prism with length 7 width 4 and height 3 is 122.
Find the surface area of a cylinder with radius 6 and height 4?

![Diagram of a cylinder with radius 6 and height 4]

Solution

The surface area of a cylinder looks like two circles and a rectangle, with one side length being the height, and the other side length being the circumference of the circles.

The area of one of the circles = \( \pi r^2 = \pi * 6 * 6 = 36 \pi \).

Both circles will have the same area, so multiply this by 2.

Now, add the area of the rectangle.

The Circumference of the circle = one side of the rectangle = \( 2 * \pi * r = 2 * \pi * 6 = 12\pi \)

Area of rectangle = circumference of circle * height = \( 12\pi * 4 = 48\pi \).

The surface area of the whole cylinder = area of rectangle + area of bottom circle + area of top circle = area of rectangle + 2 * area of bottom circle = \( 48\pi + 2 * 36\pi = 120\pi \)

The surface area of a cylinder with height 4 and radius 6 is 120\( \pi \) square units or about 120 * 3.14 = 376.8 square units.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Surface_Area"

* This page was last modified 02:01, 7 May 2008.
Symbolization Articulation

From TeacherWiki

Contents

- 1 Definition
- 2 How It’s Used
- 3 Example
  - 3.1 Symbolization/Actualization

Definition

Representing a value or equation with a variable.

How It’s Used

Substitutions are made to either allow one to work through the problem or make the problem easier to understand.

Below is an example.

Example

Symbolization/Actualization

Jake reads in the newspaper that the U.S. dollar is losing its value. One U.S. dollar was worth 86 cents in Canadian money. If \( n \) stands for the number of U.S. dollars, write the equation that gives the value, \( C \), of those dollars in Canadian money?

Solution

We know 1 U.S dollar is equal to .86 dollars in Canada. We can rewrite this as

\[
1 \text{ U.S dollar} = .86 \text{ Canada dollar}
\]

\[
1n = .86 C
\]

\[
1n/.86 = C
\]

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Symbolization_Articulation"

- This page was last modified 16:23, 15 April 2008.
Venn Diagram

From TeacherWiki

Contents

- 1 Definition
- 2 How Its Used
- 3 Example
  - 3.1 Reading a Venn Diagram
  - 3.2 Application

Definition

A picture made up of overlapping circles to show the relationships between groups.

How Its Used

That which the elements in one circle have in common with another circle is in its shared region.

Below is an example using primary colors
Example

Reading a Venn Diagram

According to the Venn Diagram below, how many people watch TV and do their homework but do not read a book after school?

![Venn Diagram](http://nth5.wpi.edu/wiki/index.php/Venn_Diagram)

After school activities

Solution

Look at where the circle for watching TV overlaps with doing homework, but not with reading a book, shaded in the picture below.
4 people do homework and watch TV but do not read a book after school.

Application

Students at Hogwarts can take Defense Against the Dark Arts, Charms, both, or neither. The percentages of Hogwarts students involved in each of the classes are shown in the venn diagram below

Courses taken by students at Hogwarts

What percent of students at Hogwarts take neither Defense Against the Dark Arts or Charms?

Solution

The Diagram tells us that 30% of the students are in Defense Against the Dark Arts and not Charms.

We also know that 50% of the students are in Charms and not Defense Against the Dark Arts.
10% of students are in both.

This means that 30% + 50% + 10% are in some combination of both Charms and Defense Against the Dark Arts.

90% of the students are in either Defense Against the Dark Arts, Charms, or both.

100% represents all of the students at Hogwarts.

100% - 90% = 10%

10% of Hogwarts takes neither Defense Against the Dark Arts or Charms

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Venn_Diagram"

- This page was last modified 02:43, 21 March 2008.
Mean

From TeacherWiki

Mean

Definition

The mean is the average of the numbers given to you in a set.

Example

To find the mean, or average, of some numbers, you simply add all the numbers together, and then divide that number by how many numbers you have in the set.

Say you are given the numbers:

21, 33, 48, 51, 67

To find the mean, add up the numbers.

\[21 + 33 + 48 + 51 + 67 = 220\]

Then divide that number by how many numbers you were given in the set.

\[220/5 = 44\]

44 is the mean of those numbers.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Mean"

- This page was last modified 14:14, 7 April 2008.
Median

From TeacherWiki

Contents

- 1 Median
  - 1.1 Definition
    - 1.1.1 Example
      - 1.1.1.1 Find the Median
      - 1.1.1.2 Find the Median

 Median

Definition

The middle number in a set of values.

The median is the number in the middle of all the numbers given to you for a problem.

Example

Find the Median

7, 85, 22, 64, 37

First have to arrange the numbers from least to greatest.

7, 22, 37, 64, 85

37 is the median.

Find the Median

28, 54, 2, 78, 99, 14

You still first order the numbers from least to greatest.

2, 14, 28, 54, 78, 99

Since there is no middle number. The median is between 28 and 54. We can average those two numbers to get the median.

\[(28 + 54) \div 2\]

\[82 \div 2\]
41

41 is the median of the set.

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Median"

- This page was last modified 17:47, 18 April 2008.
Order of Operations

From TeacherWiki

Definition

The order of operations is the convention given for solving mathematical expressions.

It follows this order:

| Parenthesis, Exponents, Multiplication and Division, Addition and Subtraction |

Or

| PEMDAS |

Example

Solve this expression using the correct order of operations.

\((2+3) \times 2^2 + 4\) First evaluate what is in the parenthesis.

\((5) \times 2^2 + 4\) Then we do the exponent.

\((5) \times 2^2 + 4 = \)

\(5 \times 4 + 4 = \)

Next is multiplication.

\(5 \times 4 + 4 = \)

\(20 + 4 = \)

Finally, we add.

\(20 + 4 = 24\)

\((2+3) \times 2^2 + 4 = 24\)


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Circle Graph

From TeacherWiki

Definition

A type of graph representing percents as pieces of a circle, like slices of a pizza.

Example

Mrs. Heffernan asked her class which of the sports Baseball, Basketball Football and Hockey they liked best. 11 chose Baseball, 6 chose Basketball, 7 chose Football, 1 chose Hockey. Make a circle graph of the data.

First put the data in a table and then

<table>
<thead>
<tr>
<th>Favorite</th>
<th>No. of Students</th>
<th>Decimal</th>
<th>calculation</th>
<th>Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball</td>
<td>11</td>
<td>$11/25 = 0.44$</td>
<td>$0.44 \times 360$</td>
<td>158.4°</td>
</tr>
<tr>
<td>Basketball</td>
<td>6</td>
<td>$6/25 = 0.24$</td>
<td>$0.24 \times 360$</td>
<td>86.4°</td>
</tr>
<tr>
<td>Football</td>
<td>7</td>
<td>$7/25 = 0.28$</td>
<td>$0.28 \times 360$</td>
<td>100.8°</td>
</tr>
<tr>
<td>Hockey</td>
<td>1</td>
<td>$1/25 = 0.04$</td>
<td>$0.4 \times 360$</td>
<td>14.4°</td>
</tr>
</tbody>
</table>

Once you find the decimal amount for a selection, multiply that by 360 (the total number of degrees in a circle) to find out how many degrees you should give to each section in your circle graph.

To make the “slice” on the circle graph, we take the degree we previously calculated, and use that number as the angle of the slice.

Take Basketball for example. We found the percent of the students who play basketball to be 24%. When we multiplied that percent by 360, we got 158.4°. To find the slice, use a protractor and measure 158.4° on the circle graph. We would put basketball starting from where baseball left off on the graph, and then start the next category starting from where basketball leaves off.
Favorite Sports

- Baseball: 158.4
- Basketball: 86.4
- Football: 100.8
- Hockey: 14.4

Retrieved from "http://nth5.wpi.edu/wiki/index.php/Circle_Graph"

- This page was last modified 23:52, 21 April 2008.