$30 + 20$	$26 - 8$	$7 + 8$	$12 \div 3$	$91 + 81$

Complete the multiplication table below:
($2 \times 3 = 6$ is done for you as an example.)

times	2	5	6	10	11
3	6				
4					
7					
8					
9					
12					

30×2	6×4	$71 + 81$	$12 \div 3$	$9 + 8$
3×4	$62 + 48$	6×3	7×3	$112 + 121$
$27 + 3$	7×7	6×6	4×8	$14 + 8$
9×3	$19 + 16$	$135 + 45$	5×12	11×3

Challenge question:
Find all the numbers less than 30 which are multiples of only 2 and/or 3. For example, the smallest three of them are 2, 3, and 6 ($= 2 \times 3$). (There are eight others besides those three.)

55×2	8×8	$233 + 377$	$21 \div 3$	$13 + 8$
8×5	$55 + 34$	8×3	21×3	$144 + 233$
$1 + 2 + 5$	$2 \times 3 \times 5$	13×8	4×9	$55 + 89$

A question on bunnies:
Eight hundred years ago, a man called Fibonacci thought about bunnies, and how older bunnies become parents and make more bunnies. His famous model of bunny love says that to find the total number of bunnies each month, you add the number of bunnies that were there in the previous two months. If we start with 1 bunny in month 1, and 1 bunny in month 2, then there will be $1 + 1 = 2$ bunnies in month three.

These are called the Fibonacci numbers, and the first few are:

$F_1 = 1$, $F_2 = 1$, $F_3 = 2$, $F_4 = 3$, $F_5 = 5$, $F_6 = 8$, $F_7 = 13$, $F_8 = 21$.

The next one would be $F_9 = F_8 + F_7 = 21 + 13 = 34$.
Can you find a pattern in which Fibonacci numbers are odd and which are even?

times	2	3	7	8	9
3					
4					
5					
6					
9					

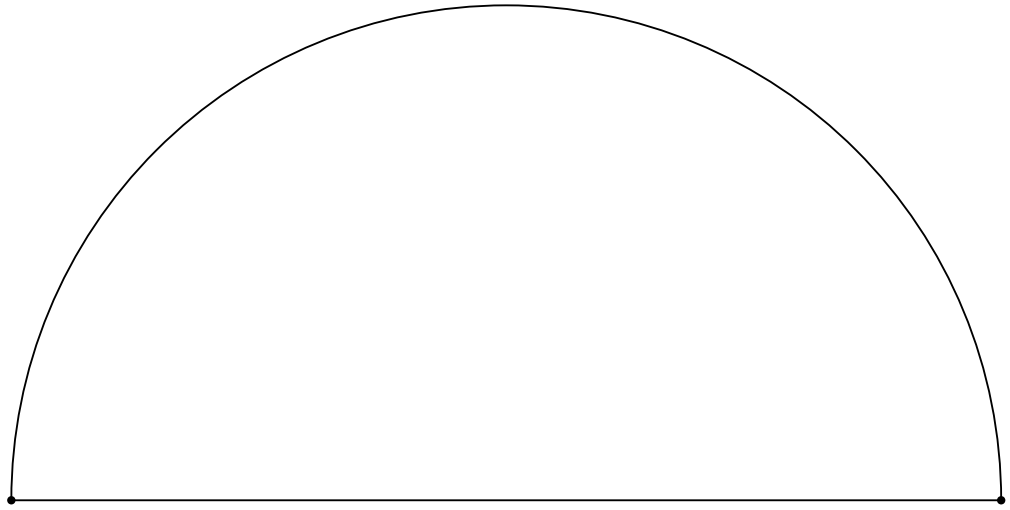
Suppose you are making a necklace out of beads, and you have some large beads and some small beads. You decide you will use a pattern of:
small-small-large-small-small-large-. . .

You have two colors of large beads (red and blue), and three colors of small beads (green, purple, and black). How many color choices do you have if you repeat them in the pattern? (For example, one choice would be green-green-red, and another would be purple-green-blue.)

32×2	$28 \div 7$	$700 \div 7$	$36 \div 3$	$14 + 21$
7×5	$70 + 35$	6×7	21×5	$105 + 35$
$22 + 33 + 55$	$2 \times 3 \times 7$	15×7	7×9	$14 + 56$
$728 + 4$	3×5	12×8	4×9	$56 + 89$

180×2	$90 \div 2$	$90 \div 9$	$60 \div 3$	$24 + 36$
27×5	$72 + 108$	6×8	12×5	$105 + 75$
$36 + 72 + 72$	$6 \times 6 \times 10$	$60 \div 4$	$60 \div 12$	$28 + 49$

You will need a straigtedge (a ruler for example) for this problem. Choose a point on the semicircle. Draw straight lines from the corners of the semicircle to that point, forming a triangle. What is the angle of the triangle at the point you chose?



$800 \div 8$	$32 \div 4$	$832 \div 4$	$11 \div 10$	$35 + 35$
$63 - 7$	$246 + 975$	8×7	8×17	$360 - 270$
$10 + 11 + 12$	6×5	11×3	$10000 - 1$	$2.27 - 2.03$

1. What is $\frac{1}{2} + \frac{1}{4}$?

2. What is $\frac{1}{2} + \frac{1}{3}$?

3. What is $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$?

$12 \div 3$	$12 \div 4$	$728 \div 7$	$110 \div 10$	$100 - 64$
$70 - 7$	$999,999 + 1$	9×7	13×13	$144 \div 12$

What is $\frac{1}{3} + \frac{1}{4}$? (Hint: draw a circle into quarters, then divide each quarter into three pieces.)

132	77	12	330	100
$\div 11$	$+ 55$	$\times 11$	$\div 11$	$- 36$

70	$999,999$	9	13	156
$- 14$	$+ 2$	$\times 5$	$\times 9$	$\div 12$

1. Was ist neun plus fünf?

2. Was ist zwölf plus elf?

3. Was ist drei mal vier multipliziert?

$89 + 98$	$9999 \div 11$	9×12	$125 \div 5$	$100 - 48$
$70 - 42$	$999,999 - 999,899$	7×7	9×9	-14×3

1. Was ist seiben plus vier?

2. Was ist sechs mal zehn multipliziert?

3. Was ist acht mal acht multipliziert?

$13 + 13$	$52 \div 13$	9×13	$169 \div 13$	$100 - 13$

$91 - 42$	$1000 - 987$	13×7	13×5	15×12

Twelves: 12, 24, 36, 48, 60, 72, 84, 96, 108, 120
Fifteens: 15, 30, 45, 60, 75, 90, 105, 120, 135, 150

1. Using the lists above, find the smallest number that is a multiple of both 15 and 12.

2. What is $2 \times 2 \times 3 \times 5$?

3. What is the smallest number that is a multiple of both 6 and 10?

$18 + 18$	24×3	$72 \div 8$	$143 \div 13$	$123 - 25$
$10 - 7$	$100 - 87$	3×7	20×5	5×8

1. If $Z - 2 = 10$, what is Z?

19	32	72	260	1001
$+\ 17$	$\times\ 3$	$\div\ 9$	$\div\ 13$	$-\ 110$

$123,456,789$	101	50	50	15
$-\ 12,345,567$	$-\ 76$	$\times\ 5$	$\times\ 50$	$\times\ 8$

1. If $Z - 5 = 15$, what is Z?

2. If $3Z = 15$, what is Z?

3. If $Z \div 10 = 10$, what is Z?

4. If $Z + 1 = 2 - Z$, what is Z?

5×5	50×5	500×2	500×5	$64 - 48$
$999,999,999 - 12,345,678$	$102 - 77$	$60 \div 6$	$3600 \div 6$	22×5
9×4	4×8	7×7	6×6	3×3

The problems below are about averages. The two most common ways to average a set of numbers are using the: *mean*, where you add up all the numbers and divide by how many there are, and the *median*, where you sort the numbers and then pick the middle value.

Here is an example: if the numbers are 5, 4, 1, 10, and 100, then

$$\text{mean} = \frac{5+4+1+10+100}{4} = \frac{120}{5} = 24.$$

The median is 5, since it is the middle number once they are sorted: $1, 4, 5, 10, 100$.

1. Suppose Mary has 1 dollar, Sam has 1 dollar, Jack has no dollars, Wilma has 8 dollars, and Barbu has 100 dollars. What is the mean number of dollars for these five people? What is the median number of dollars?

$$\begin{array}{r} 12 \\ \times\ 5 \\ \hline \end{array} \qquad \begin{array}{r} 12 \\ \times\ 12 \\ \hline \end{array} \qquad \begin{array}{r} 123 \\ \times\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 500 \\ -\ 5 \\ \hline \end{array} \qquad \begin{array}{r} 96 \\ -\ 48 \\ \hline \end{array}$$

$$\begin{array}{r} 100,000,001 \\ -\ 3 \\ \hline \end{array} \qquad \begin{array}{r} 100 \\ -\ 11 \\ \hline \end{array} \qquad \begin{array}{r} 17 \\ +\ 43 \\ \hline \end{array} \qquad \begin{array}{r} 720 \\ \div\ 6 \\ \hline \end{array} \qquad \begin{array}{r} 7 \\ \times\ 3 \\ \hline \end{array}$$

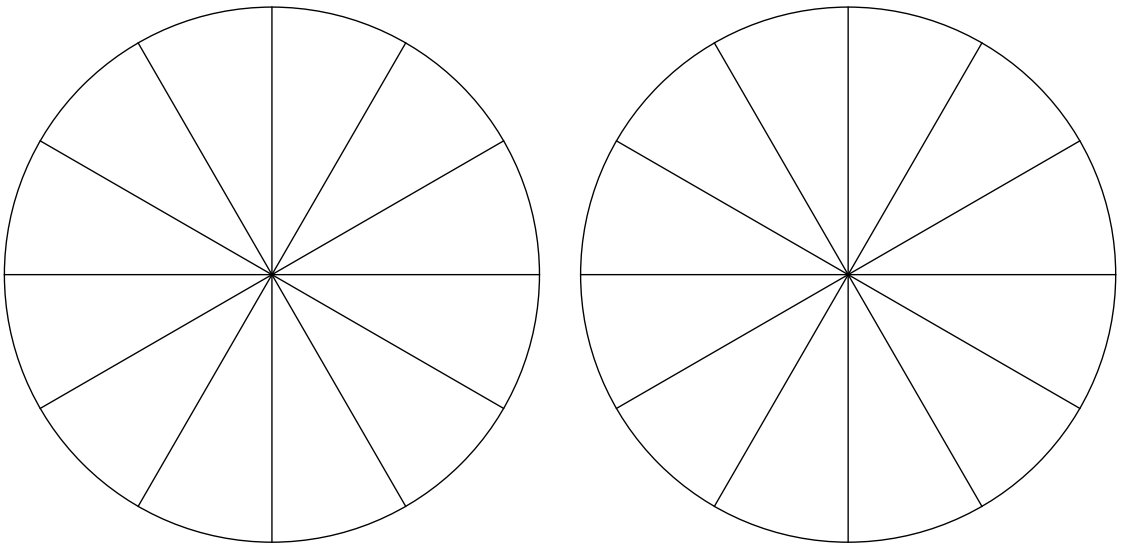
1. Was ist vier plus sechs?

2. Number riddle: I am a number, less than 100. If you divide me by 6, you get an even number. If you divide me by 12, you get an odd number. I end in a zero.

3. What is $\frac{1}{2} + \frac{2}{3}$? (Hint: how many sixths is $\frac{1}{2}$? How many sixths is $\frac{2}{3}$?)

3×4	2×6	321×4	$5.23 - 2.28$	$128 - 64$
100×10	100×100	$274 + 777$	$720 \div 6$	6×7

1. What is $\frac{2}{3} + \frac{3}{4}$? Use the two circles below to help (count the twelfths):



3×5	13×5	$117 \div 9$	$1.37 - 0.38$	$1024 - 512$

100×11	100×111	$6 + 595$	$336 \div 7$	4×7

1. Number riddle: I am a number, less than twenty. If you divided me by 5, you would get a remainder of 3. If you divided me by 3, you would get a remainder of 1. In German, I begin with a 'd'.

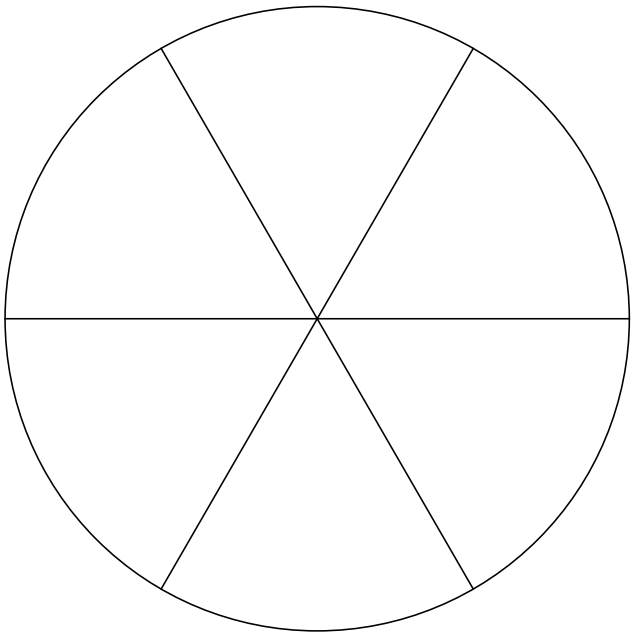
2. What is $\frac{1}{3} + \frac{1}{5}$? (Hint: use the smallest common multiple of 3 and 5.)

24	6	120	2	2048
$\times$ 5	$\times$ 6	$\div$ 3	$-$ 0.25	$-$ 1023

11	1000	26	8	336
$\times$ 11	$\times$ 1000	$+$ 77	$\times$ 4	$\div$ 8

1. Number riddle: I am a number, less than forty. If you divided me by 7, you would get a remainder of 6. If you divided me by 3, you would get a remainder of 2. In German, I begin with a 'z'.

2. What is $\frac{1}{3} + \frac{1}{6}$?



144×2	144×5	$360 \div 3$	$1.75 + 0.25$	$4096 - 2048$

$12 \times \frac{1}{2}$	101×1000	$55 + 84$	40×9	$360 \div 12$

1. What is $\frac{1}{5} + \frac{1}{10}$?

2. If you turn in a full circle, you go around 360 degrees. If you walked in a five-pointed star, you end up turning around twice. Since $360 + 360 = 720$, at each point of the star you need to turn $720 \div 5$ degrees.

   Write a Scratch program using the turn, move, repeat, and pen down commands to draw a five-pointed star.

80×9	32×5	$360 \div 8$	$1.75 \div 0.25$	$8192 - 4096$
$15 \times \frac{1}{3}$	$100 \times \frac{1}{10}$	$55 + 89$	160×9	$120 \div 15$

1. What is $\frac{1}{3} + \frac{2}{15}$?

2. Can you modify your Scratch program to make a nine-pointed star? Hint: $360 \div 9 = 40$, and the angle you need to turn is a multiple of that.

180×3	24×5	$360 \div 12$	$1.00 \div 0.05$	$16384 - 8192$
$15 \times \frac{1}{5}$	$100 \times \frac{2}{100}$	$144 + 89$	250×8	$120 \div 30$

1. What is $\frac{1}{6} + \frac{1}{4}$?

5×5	6×4	7×3	8×2	9×1
6×6	7×5	8×4	9×3	10×2
9×9	10×8	11×7	12×6	13×5
$80 - 77$	$24 - 21$	$32 - 27$	$16 - 9$	$72 - 65$

1. There is a pattern to the questions in the first three rows. Is there a pattern in the answers?

$180 \div 3$	36×5	15×24	$360 \div 15$	$32768 - 16384$

$32 \times \frac{1}{4}$	$\frac{\frac{1}{4}}{\times \frac{1}{4}}$	$144 - 89$	125×8	$1024 \div 4$

1. What is $\frac{1}{4} + \frac{2}{5}$?

2. The divisors of a number are all of the numbers that divide it with no remainder. Usually we just use the positive divisors.

   For example, the positive divisors of 12 are $1, 2, 3, 4, 6$, and 12.

   What are the positive divisors of 10?

$360 \div 4$	18×5	15×5	$210 \div 6$	$65536 \div 2$
$32 \times \frac{1}{8}$	$\frac{\frac{1}{2}}{\times \frac{1}{3}}$	$256 - 128$	75×4	$1024 \div 8$

1. The children Victoria, Wanda, Xavier, Yves, and Zelda each have some pets. The pets are 4 frogs, 1 dog, 9 mice, 16 hermit crabs, and 50 fireflies. The ages of the children are 8, 10, 12, 13, and 15. Figure out which kid has which pet and age from the clues below:

   a) Zelda's age is only one less than the number of her pets.

   b) Xavier likes extremes - he wanted to have either the most or the fewest pets.

   c) The same boy is the median age and has the median number of pets.

   d) Wanda likes numbers, and she likes that her both her age and number of pets are multiples of 2. Her only regret is that the number of her pets is not the mean or the median.

   e) Victoria thinks the other kids have weird pets. She was talking to Wanda and Zelda and said, 'You should have chosen a mammal like I did!'.

   f) Zelda is older than Wanda or Victoria. Their ages are both Fibonacci numbers though.

$$\begin{array}{r} 720 \\ \div\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 17 \\ \times\ 5 \\ \hline \end{array} \qquad \begin{array}{r} 9 \\ \times\ 5 \\ \hline \end{array} \qquad \begin{array}{r} 210 \\ \div\ 7 \\ \hline \end{array} \qquad \begin{array}{r} 65536 \\ \div\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 32 \\ \div\ 16 \\ \hline \end{array} \qquad \begin{array}{r} \frac{1}{2} \\ \times\ 3 \\ \hline \end{array} \qquad \begin{array}{r} 196 \\ -\ 128 \\ \hline \end{array} \qquad \begin{array}{r} 12 \\ \times\ \frac{3}{4} \\ \hline \end{array} \qquad \begin{array}{r} 75 \\ \times\ 12 \\ \hline \end{array}$$

The distributive law says that for any three numbers a, b, and c,

$$a \times (b + c) = a \times b + a \times c$$

This can be useful sometimes. For example, to calculate 5×995, we could do

$$\begin{array}{r} 995 \\ \times\ 5 \\ \hline 25 \\ 450 \\ +4500 \\ \hline 4975 \end{array}$$

or we could do

$$5 \times 995 = 5 \times (1000 - 5) = 5 \times 1000 - 5 \times 5 = 5000 - 25 = 4975.$$

1. Use the distributive law to calculate 3×9998.

$720 \div 6$	21×5	8×6	$210 \div 5$	$65536 \div 8$
$32 \div 4$	$\frac{2}{5} + \frac{2}{3}$	$243 \div 3$	12×0.75	5×3

Fill in the blank:

1. $5 \times 995 = 5 \times \_\_\_\_\_ - 5 \times 5$

2. $1.25 = \frac{\_}{4}$

(1) If I eat half of a pumpkin pie, and you eat a third of a pumpkin pie, and mom eats a sixth of a pumpkin pie, how much pie is left over?

(2) We have about 140 pieces of candy to give out for Halloween. How many pieces per child should we hand out if a total of 30 kids come to our house?

(3) At four pm this evening the temperature is predicted to be 41 °Fahrenheit. Convert this to degrees Celsius by first subtracting 32 and then multiplying by $\frac{5}{9}$. (For example, water boils at 212°F. First we substract 32: $212 - 32 = 180$. Then we multiply by $\frac{5}{9}$ to get $180 \times \frac{5}{9} = 100$°C.)

$60 \div 5$	25×5	25×4	2.5×4	0.25×4
0.4×25	$\frac{2}{5} + \frac{3}{5}$	$81 \div 3$	12×0.25	$15 \div 3$

Fill in the blank:

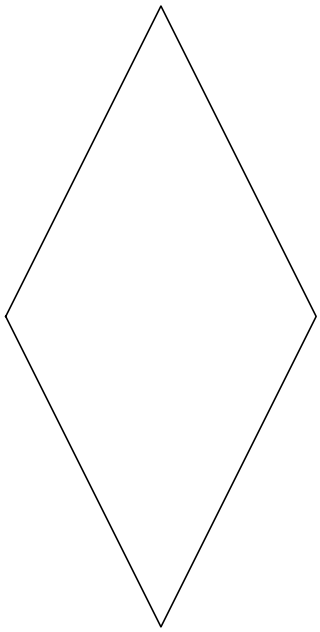
1. If I have 135 party favors and 25 people come to my party, how many party favors should I give out to each person?

2. If 25 people buy a giant chocolate bunny for $140 dollars, how much should each person pay?

3. Which is larger, 1.5 or $\frac{7}{5}$?

$60 \div 6$	15×5	33×3	13×13	$50 - 4$
$180 - 45$	$\frac{12}{15} + \frac{18}{15}$	$231 \div 3$	12×12	$45 \div 3$

1. A *rhombus* has four sides of the same length. If all of the interior angles are 90 degrees, then its a square. Turned on their points they are often called diamonds. Write a Scratch program that draws a rhombus. Can you make it so it could draw any shape of rhombus? (The shape is determined by the length of a side and one angle. Two angles in a row have to add up to 180 degrees.)

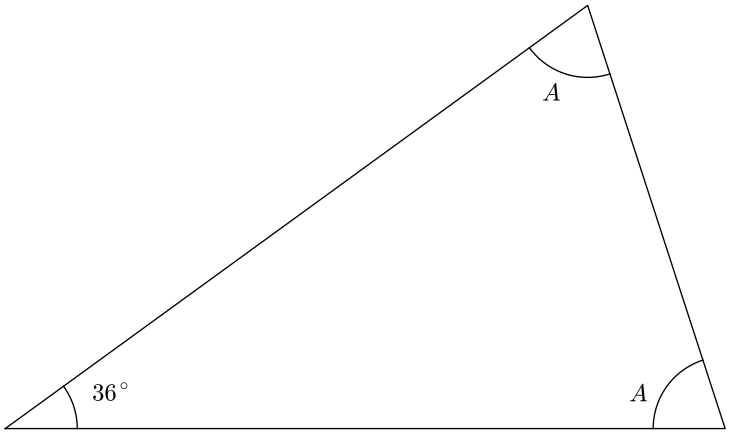


$$\begin{array}{r} 8 \\ \times\ 1 \\ \hline \end{array} \qquad \begin{array}{r} 88 \\ \times\ 11 \\ \hline \end{array} \qquad \begin{array}{r} 888 \\ \times\ 111 \\ \hline \end{array} \qquad \begin{array}{r} 11 \\ \times\ 11 \\ \hline \end{array} \qquad \begin{array}{r} 12321 \\ \div\ 111 \\ \hline \end{array}$$

$$\begin{array}{r} 180 \\ -\ 72 \\ \hline \end{array} \qquad \begin{array}{r} \frac{12}{15} \\ +\ \frac{18}{15} \\ \hline \end{array} \qquad \begin{array}{r} 231 \\ \div 7 \\ \hline \end{array} \qquad \begin{array}{r} 14 \\ \times\ 14 \\ \hline \end{array} \qquad \begin{array}{r} 108 \\ \div\ 2 \\ \hline \end{array}$$

1. Play the $3n + 1$ game with the number 53. (If its odd, triple it and add one; if its even, divide by two.) Write down all the steps!

2. The interior angles of a triangle add up to 180 degrees. The isosceles triangle below has two angles equal to A and one equal to 36 degrees. What is A?



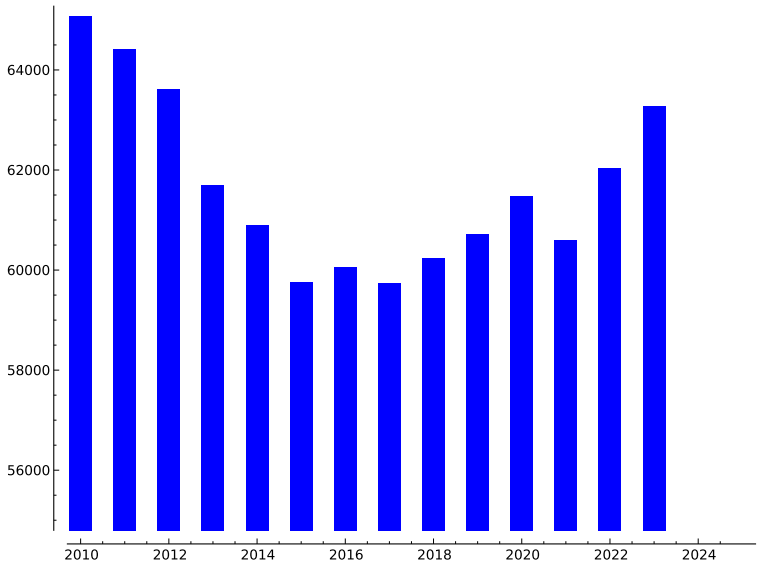
8×3	$88 \div 11$	100×0.01	12×9	$1234321 \div 1111$

$5^2 - 4^2$	$\frac{17}{15} + \frac{28}{15}$	$\sqrt{64} \div \sqrt{4}$	15×15	$108 \div 9$

1. The chart below shows the expected number of graduating high school seniors in Minnesota from 2010 until 2023.

   a) If you graduate from high school when you are 18 years old, about how many other high school graduates will there be in Minnesota?

   b) Without doing the full calculation, estimate the mean (average) number of high school graduates in Minnesota over this time period (2010-2023).



1. What is $2 \times 2 \times 4$?

2. What is 1050×1000?

3. If $12 \times m = 36$, what is m?

4. What's 117 divided by 9?

5. What is 0.01 more than 2.5?

6. What is $\frac{2}{3} - \frac{1}{4}$?

7. How many minutes are in an hour?

8. How many minutes are in a day?

9. $24 = 2^3 \times 3$. Can you factor 36 in a similar way?

10. There are two cups in a pint. There are two pints in a quart. There are four quarts in a gallon. How many cups are in a gallon?

1. If $12 \times m = 132$, what is m?

2. If you are dealt a card from a normal (52-card) deck, what is the chance that you get a spade? What is the simplest way to write that answer (hint: there are four suits in a deck)?

3. What's 126 divided by 9?

4. What is $1^3 + 3^3 + 5^3$?

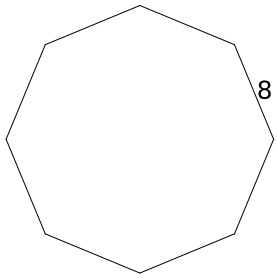
5. What is $\frac{2}{5} - \frac{2}{4}$?

6. If a fathom is six feet, how many inches is a fathom?

7. What is 100×200?

8. The weights of gems are sometimes measured in points or carats. Each point is 2 mg (mg=milligrams, so a point is 2 thousandths of a gram). There are a hundred points in a carat. A *paragon diamond* is a flawless diamond weighing at least 100 carats. How many grams must a paragon diamond weigh?

9. What is the perimeter of an octagon if each side is 8 inches long?



1. If $2 \times m = 3 + m$, what is m?

2. If you flip a coin twice, what is the chance that you get two heads?

3. If you flip a coin twice, what is the chance that you get a head and a tail (in either order)?

4. What is $1^1 + 7^2 + 5^3$?

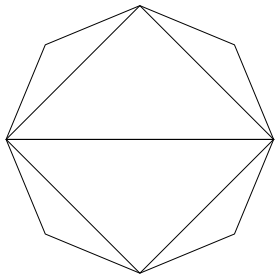
5. What is $\frac{5}{4} - \frac{4}{5}$?

6. If you had a nicely stacked pile of wood that was 8 feet wide and 4 feet deep and 4 feet high, you would have a *cord* of wood. This means there are $8 \times 4 \times 4$ cubic feet in a cord. How many cubic feet is that?

7. What is 2^7?

8. π cannot be written as a fraction. It is approximately 3.14159. What is π rounded to the nearest tenth?

9. The interior angles of a triangle add up to 180 degrees. If you added up all the interior angles of an octagon how many degrees would it be?



8×7	9×5	9×6	9×7	12×9
$36 \div 4$	$225 \div 15$	$49 \div 7$	16×16	$117 \div 9$

1. The sum of the internal angles of a triangle is 180 degrees. What is the sum of the internal angles of a rectangle?

2. The distance between two bases on a standard baseball field is 90 feet. What is the perimeter of a baseball diamond?

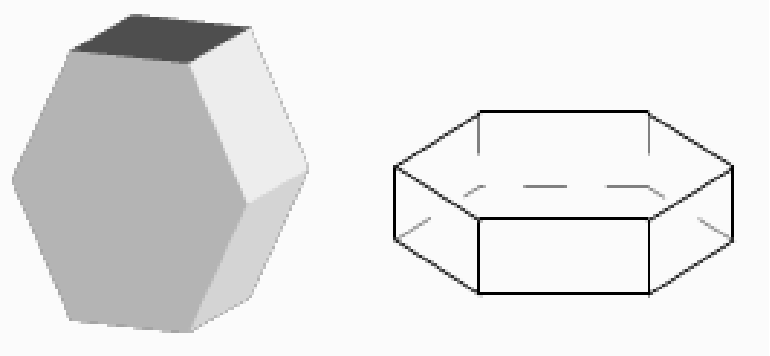
3. You are helping to plan a party and need to know how much it will cost. The ballroom will cost $100 no matter how many people show up. Each person that shows up will cost $4.50. Can you write a Scratch program that asks how many people will show up and then says how much the cost of the party will be?

8×5	9×4	$144 \div 12$	14×3	22×11
$360 \div 3$	$120 \div 3$	$40 \div 4$	2×5	$126 \div 9$

1. The sum of the internal angles of a pentagon is 540 degrees. What is the sum of the external angles of a pentagon?

2. Can you write 360 as a product of powers of 2, 3, and 5? (Hint: $36 = 2^2 \times 3^2$.)

3. Shown below are two sketches of a hexagonal prism. Can you sketch a pentagonal prism?



18×5	45×8	$144 \div 3$	14×4	101×101
$360 \div 15$	$\frac{3}{4} \div 6$	$484 \div 4$	222×5	$135 \div 9$

1. Which is larger, 1.5 or $\frac{18}{12}$?

2. Which is larger, 1.5 or $\frac{19}{12}$?

3. $48 = 3 \times 2^{\square}$ (fill in the missing exponent).

6×4	24×5	120×6	14×5	101×99
$360 \div 5$	$0.85 + 0.15$	$480 \div 8$	333×5	$144 \div 9$

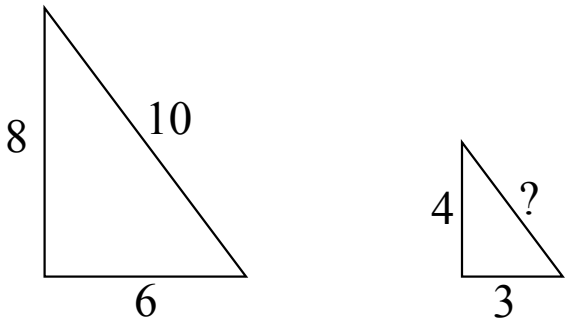
1. Factorials: the notation $n!$ means $n \times (n-1) \times \ldots \times 1$.

   For example, $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$.

   Compute $6!$.

2. Can you write a Scratch program that computes factorials? (As a test of your program, it should say that $10! = 3628800$.)

3. In geometry we say that two things are *similar* if they are the same shape, but not necessarily the same size. The two triangles shown below are similar. Can you figure out how long the hypotenuse of the smaller triangle is?



6×7	$24 \div 4$	$120 \div 5$	15×5	105×95

$365 \div 5$	$0.09 + 1.15$	$136 \div 8$	81×3	$243 \div 3$

1. What is $\frac{1}{2} + \frac{1}{4} + \frac{1}{8}$?

Here are some examples of logarithms:
$\log_2(8) = \log_2(2^3) = 3$.
$\log_3(27) = \log_3(3^3) = 3$.
$\log_{10}(100) = \log_{10}(10^2) = 2$
and $\log_{10}(1000) = 3$

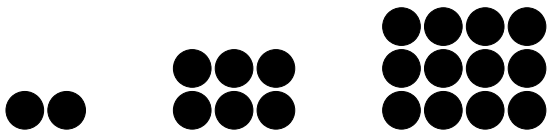
2. What do you think $\log_{10}(10000) =$?

14×3	8×7	40×4	$1039 - 997$	40×40
$210 \div 5$	13×14	$20.19 + 21.81$	$729 \div 9$	$294 \div 7$

1. What is $\sqrt{1764}$?

2. At 11:47 am mom puts some banana-apple bread in the oven. If it takes 55 minutes to bake the bread, at what time should she take it out of the oven?

3. Consider the pattern of dots below. The first figure has two dots; how many dots would the sixth figure have? How about the 10th figure?



1. $\frac{1}{2} + \frac{1}{4} =$

2. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} =$

3. $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} =$

4. Use the pattern in problems 1,2, and 3 to guess an answer to

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \frac{1}{64} + \frac{1}{128} =$$

5. If you have a rectangle whose perimeter is 36 inches, how long and wide is the rectangle?

6. What is the mean (average) of the list of the numbers: $1, 1, 4, 6$?

7. Which number is larger, $\frac{1}{3}$ or 0.26?

8. Here is the factorization of 24: $24 = 2 \times 2 \times 2 \times 3$. What is the factorization of 54?

1. $\frac{1}{11} + \frac{2}{33} =$

2. The number 42.31 could be written out as 'forty-two and thirty-one hundredths'. Write out the number 123.42 in a similar way.

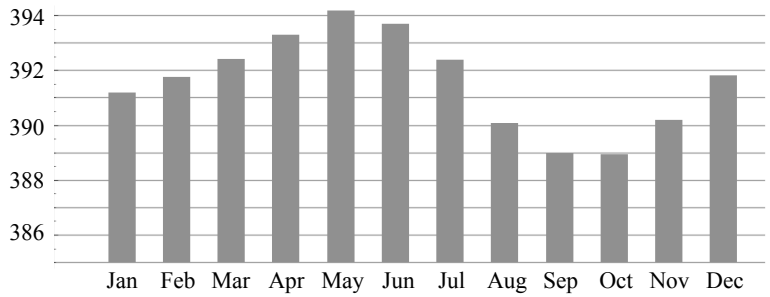
3. Round the number 0.36 to the nearest tenth.

4. The numbers x and y have the following properties: $x + 1 = 2$, and $x + y = 5$. What are x and y?

5. The divisors of 27 are 1, 3, 9, and 27. What are the divisors of 28? (Hint: there are six of them.)

6. Which number is larger, $\frac{2}{3}$ or 0.75?

7. The chart below shows how much carbon dioxide (CO_2) was in the atmosphere each month in 2011. Which month had the highest level of CO_2? Can you guess why?



16	9	45	2039	50
$\times$ 3	$\times$ 6	$\div$ 9	$-$ 1994	$\times$ 50

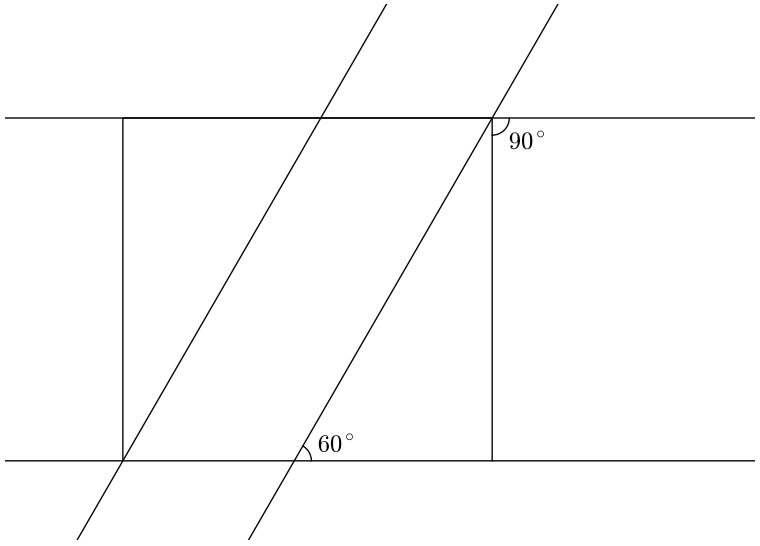
225	9	1.29	729	245
$\div$ 5	$\times$ 9	+ 21.88	$\div$ 27	$\div$ 7

1. Circle the prime numbers which are factors of 245:

   2 3 5 7 11 13 17

2. Round the numbers 58 and 33 to the nearest ten, and multiple the rounded numbers.

3. Mark all of the angles in the picture below which are 60 degrees. The angles in a triangle add up to 180 degrees, and so do the angles on one side of a straight line.



1. Circle the correct equation.

   a) $\frac{4}{10} = \frac{3}{6}$ b) $\frac{1}{2} = \frac{7}{8}$ c) $\frac{1}{2} = \frac{3}{6}$ d) $\frac{4}{10} = \frac{7}{8}$

2. Which pair of expressions are equivalent to each other?

   a) $2 \times 2 \times 2$ and 3^2 b) $6 \times 6 \times 6 \times 6$ and 4^6

   c) $4 \times 4 \times 4 \times 4 \times 4$ and 4^5 d) $8 \times 8 \times 8 \times 8 \times 8 \times 8$ and 8^8

3. If $7 + x = 84$, what is x?

4. There are 60 hikers who need to get across a lake in boats. Each boat can hold up to 7 hikers. What is the least number of boats needed to take all the hikers across the lake in one trip?

5. Norman took a 6-hour car trip. During the first 4 hours, he drove 65 miles each hour. During the next 2 hours, Norman drove 40 miles each hour. What is the total number of miles Norman drove during his entire 6-hour car trip?

6. Mary picks 15 flowers from her garden. If 3 out of 5 of these flowers are yellow, how many yellow flowers did Mary pick?

7. A bus has 14 rows with 4 passenger seats in each row. What is the total number of passenger seats on the bus?

8. What is $7^2 + 9 + 1^3$?

16×3	8×6	$48 \div 4$	$4096 - 2048$	51×49
$336 \div 6$	11×11	$11.29 - 10.08$	$336 \div 8$	$336 \div 7$

1. Circle the prime numbers which are factors (divisors) of 336:

   2 3 5 7 11 13 17

2. Round the numbers 199 and 54 to the nearest ten, and multiple the rounded numbers.

3. The Board of Directors for the company Uranus Systems has 16 people on it. The company's charter (similar to a constitution) says that in order to change the name of the company, at least 75% of the members of the board must vote in favor of the change. How many votes are needed to change the name of Uranus Systems?

4. Suppose you roll two six-sided dice and add up the two numbers. There is only way to get a sum equal to 2 - that happens if you roll two ones. But there are 5 ways to get them to add up to 8 (see the table below). So the chance of getting a sum of 8 is $\frac{5}{36}$. What is the chance that the sum of the two dice rolls is *at least* 10?

Dice roll 1

Dice roll 2	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

7	343	133	23	41
$\times$ 7	$\div$ 7	$\div$ 7	$-$ 35	$\times$ 39

1. Circle the prime numbers which are factors (divisors) of 343:

   2 3 5 7 11 13 17 19 23

2. The Duluth Grill is 8 miles from our house. A kilometer is 0.62 miles. **About** how many kilometers is the Duluth Grill from us?

   (A) 13 kilometers (B) 25 kilometers (C) 5 kilometers (D) 2.5 kilometers

3. You open a bag of M&M's® candy and find to your surprise that 95% of the forty candies are red, and the others are green. How many green ones are there?

4. If you eat 1/3 of a pumpkin pie, and mom eats 1/6 of the pie, and I eat 1/4 of it, and Kenya eats 1/12 of it, how much is left?

5. A triangle has two congruent sides (its an isosceles triangle). The perimeter of the triangle is 140 feet. Only one side of the triangle is 40 feet long. What is the length of each of the congruent sides?

6. Can you figure out the rule that gives the y value from the x value?

x	y
0	-1
1	2
2	5
3	8
20	59
-1	-4

x	2	3	7	8	9	10
3						
4						
5						
6						
8						

1. Alice is five years younger than her sister Carol. Carol is half the age of her cousin, Mathilda. If Mathilda is twenty years old, how old is Alice?

2. A computer that normally costs $1000 is in a sale in which everything is "20 percent off". How much does the computer cost during the sale?

3. Can you figure out the rule that gives the y value from the x value?

x	y
0	2
1	3
2	6
3	11
10	102
20	402

x	2	3	7	8	9	11
4						
5						
6						
7						
13						

1. Zoe likes her age this year because its a prime number. She has two sisters, Maud and Nell. If you add up Maud's age and Nell's age you get twice Zoe's age. Maud is only 6 - she is the youngest sister. Nell is the oldest sister - she's the only teenager, and her age is a power of two. How old is Zoe?

2. You see a book in a bookstore that you really want to buy. It says it costs $12 dollars, and you have twelve dollars and three quarters, so you happily go to the register to buy it. But as you wait in line, you realize that you forgot about the sales tax! If the sales tax is 6%, do you have enough money to buy the book?

3. If $B = A \times A + 2$, find the missing values of A and B in the table below.

A	B
0	2
1	
2	6
3	11
5	
	51
9	
10	102

6×8	80×60	$48 \div 4$	$130 - 32$	31×29
$144 \div 6$	12×12	19×21	9×11	$399 \div 7$

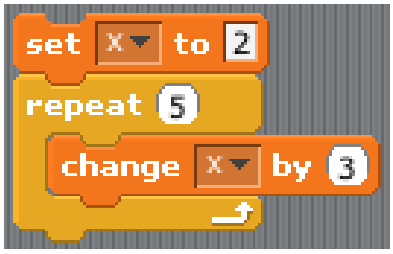
1. $1 + 2^2 + 3^3 =$

2. Round the numbers 95 and 16 to the nearest ten, and multiple the rounded numbers.

3. What is the sum of the interior angles of a triangle?

4. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} =$

5. After the following Scratch code executes, what is the value of x?



7×8	80×7	80×70	$4321 - 432$	191×9
$144 \div 8$	144×5	180×4	1001×999	$187 \div 11$

1. $3^2 + 4^2 - 5^2 =$

2. Does every triangle have at least one acute angle?

3. Can a triangle have two obtuse angles?

4. If you flip a coin three times, what is your chance of getting two heads and one tail?

5. $\frac{2}{5} + \frac{1}{6} =$

7×9	21×7	$147 \div 3$	$35 - 70$	243×9

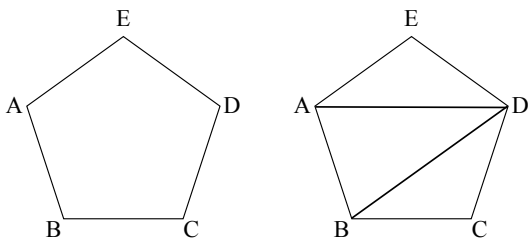
$144 \div 6$	90×8	45×16	61×59	70×8

1. $12^2 + 5^2 - 13^2 =$

2. What is the mean (average) of the numbers 10, -1, 5, 6, and 100?

3. If you flip a coin four times, what is your chance of getting four heads?

4. The figure below shows a pentagram and one possible triangulation of it. How many different ways are there of triangulating it?



11 × 11	60 × 6	60 × 60	121 + 3600	61 × 61
144 ÷ 3	12 × 8	45 × 3	240 ÷ 15	240 ÷ 8

1. If you have a choice between rolling one six-sided die and winning on a 4,5, or 6, OR rolling two dice and winning on a 5 or 6, which one should you choose?

2. Try to figure out the next number in this sequence:

   100, 101, 96, 97, 92, 93, 88, 89, _____

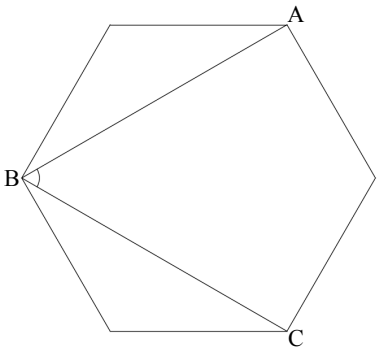
3. Melissa has a rope that is 84 feet long. She is cutting it into 7-foot pieces to make jump ropes. How many jump ropes can Melissa make?

4. Lisa collects baseball cards. She has 4,381 baseball cards in her collection. She sells 1,427 of her baseball cards. How many baseball cards does Lisa have left?

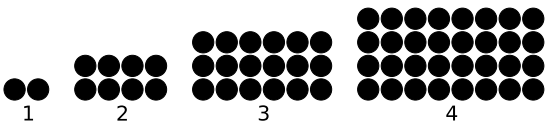
161	8	15	17	64
$\div$ 7	$\times$ 8	$\times$ 15	$\times$ 17	$+$ 225

25	25	16	360	152
$\times$ 7	$\times$ 8	$\times$ 16	$\div$ 45	$\div$ 8

1. The hexagon below is a regular hexagon - each of its sides is the same length, and each angle is the same. How many degrees is the angle ABC?



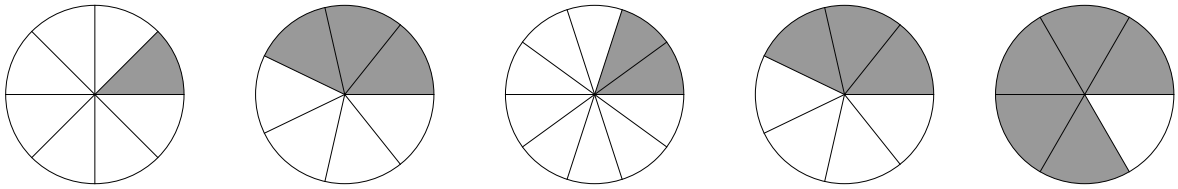
2. Consider the pattern of dots below. The first figure has two dots; how many dots would the tenth figure have?



$91 \div 7$	7×7	6×13	13×8	$169 - 25$
250×5	$125 \div 5$	$1,000 \times 1,000$	$234 \div 13$	$468 \div 13$

1. Match the fractions with the corresponding pie charts by connecting them with a line. Some of them will not be connected.

$\frac{3}{4}$	$\frac{6}{14}$	$\frac{2}{9}$	$\frac{1}{5}$	$\frac{1}{3}$



2. Do the "Complete the Cube" problem on pages 84-85 of the Math Puzzles and Games book.

$98 \div 7$	7×7	7×14	7×8	$25 - 16$
2.5×4	$625 \div 25$	100×100	29×3	$435 \div 5$

1. What is $\frac{1}{2}$ divided by $\frac{1}{2}$?

2. What is the next number in this sequence?

   1, 2, 4, 7, 11, 16, 22, ___

3. Do the "Win Big" problem on pages 50 of the Math Puzzles and Games book.

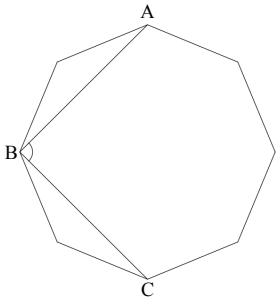
$105 \div 7$	8×8	12×8	8×6	$100 - 64$
0.125×8	$375 \div 125$	20×20	$0.5 \div 0.5$	$128 \div 8$

1. $\frac{1}{7} + \frac{1}{5} =$

2. The brothers Grendel and Drchk are quite old. If you add their ages together, you get 2000, but if you subtract Drchk's age from Grendel's, you get 2. How old is Grendel?

3. Which is larger, $\frac{13}{8}$ or 1.6?

4. The octagon below is a regular octagon - each of its sides is the same length, and each angle is the same. How many degrees is the angle ABC?



30	9	60	8	150
$\div$ 5	$\times$ 9	$\div$ 12	$\times$ 3	$-$ 90

2.5	625	60	720	128
$\times$ 24	$\div$ 125	$\times$ 7	$\div$ 12	$+$ 384

1. What is $2 \times 2 \times 3 \times 5$?

2. $\frac{1}{4} + \frac{1}{3} + \frac{1}{5} =$

84×8	$99 \div 9$	$60 \div 5$	8×5	$150 - 135$
2.5×4	125×8	125×7	$875 \div 125$	$256 - 96$

1. Helen is a photographer. She keeps her printed photos in special notebooks, each of which hold 125 photos. If she has 600 photographs, how many notebooks does she need?

2. Which number will make the inequality true?

$$(36 \times 8) \div \_\_\_ > 72$$

a) 2

b) 5

c) 6

d) 7

71	121	62	8	112
$\times$ 7	$\div$ 11	$\div$ 31	$\times$ 7	$-$ 35

0.125	333	334	1125	2048
$\times$ 8	$\times$ 6	$\times$ 6	$\div$ 125	$-$ 512

1. Which number is ten thousand seven hundred and twenty?
   a) 17,200
   b) 17,020
   c) 10,720
   d) 10,702

2. Can you figure out the rule that gives the y value from the x value?

x	y
1	4
3	8
7	16
10	22
20	42
100	202

13	12221	126	9	1023
$\times$ 31	$\div$ 11	$\div$ 9	$\times$ 7	$-$ 25

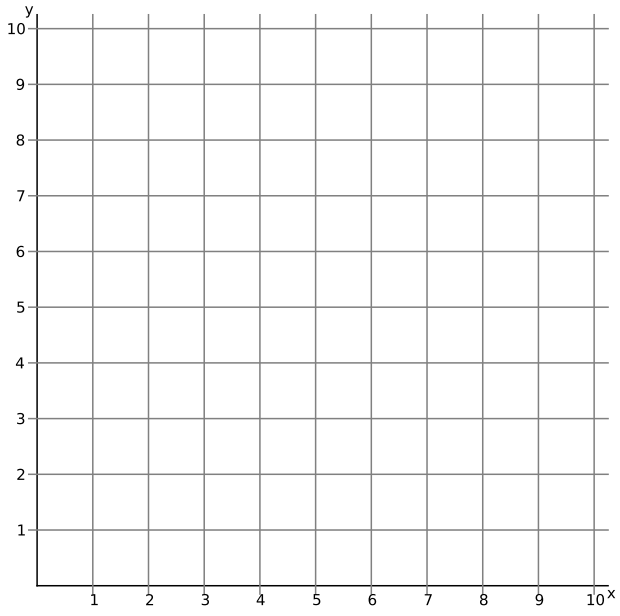
0.12	105	41	1250	5
$\times$ 50	$\times$ 5	$\times$ 6	$\div$ 125	$\times$ 9

1. Circle all the values of x that make the following inequality true:

$$1.5 + x < 10$$

   a) $x = 2.8$
   b) $x = 8.1$
   c) $x = 9.2$
   d) $x = 11.5$

2. Draw the line $y = 2x$ in the box below. The x value is horizontal, the y value is vertical. For example, if $x = 2$, then $y = 4$, and the point $(2, 4)$ is on the line.

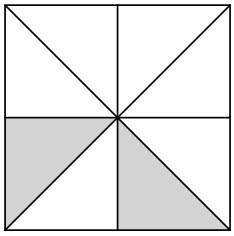


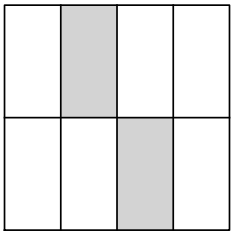
8×8	$128 \div 8$	$128 \div 2$	9×7	$1024 - 64$
128×0.5	16×4	6×6	$3200 \div 64$	64×11

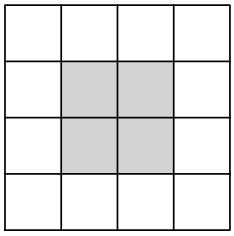
1. What is 2^6?

2. What is 2^{10} divided by 2^9? (Hint: you do not have to figure out what 2^{10} and 2^9 are to answer the question!)

3. What fraction of each square is shaded?





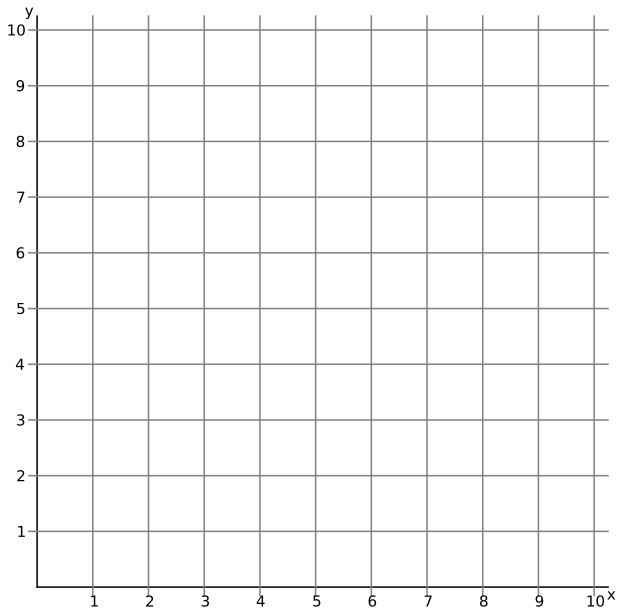


13×5	$169 \div 13$	$243 \div 3$	9×6	$50 - 32$
128×3	$57 \div 3$	3×9	$1300 \div 26$	31×31

1. What is 3^3?

2. What is 3^{10} divided by 3^8?

3. Draw a line through the points $(0, 1)$, $(1, 2)$, and $(2, 3)$. Can you find an equation for y in terms of x? (This would look like $y = a \times x + b$ where a and b are numbers.)

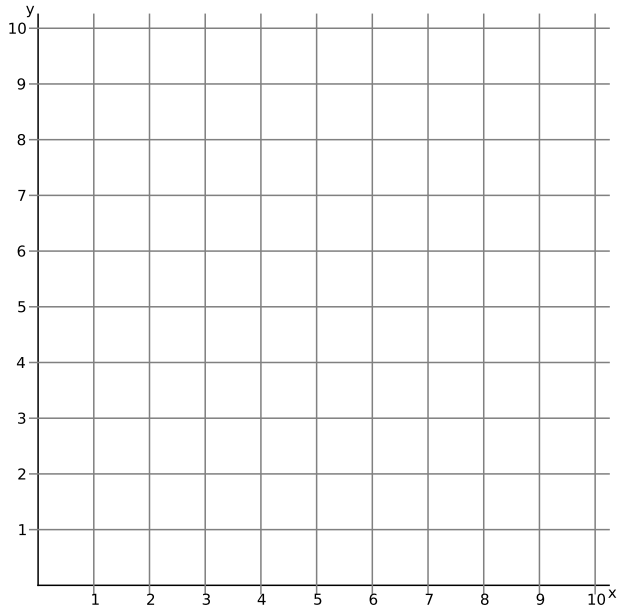


33×5	$726 \div 66$	$660 \div 3$	9×4	$52 - 43$
32×32	$72 \div 3$	4×8	$500 \div 25$	30×30

1. Considering your answers for 30×30 and 32×32, what is a good guess for the square root of one thousand ($\sqrt{1000}$)?

2. If your right hand is on the piano you can play five notes on the white keys without any shifting. If you do not play the same note twice in a row, how many ways can you play a short theme of 4 notes?

3. Draw a line through the points $(0, 7)$, $(1, 6)$, and $(3, 4)$. Can you find an equation for y in terms of x? (This would look like $y = a \times x + b$ where a and b are numbers.)



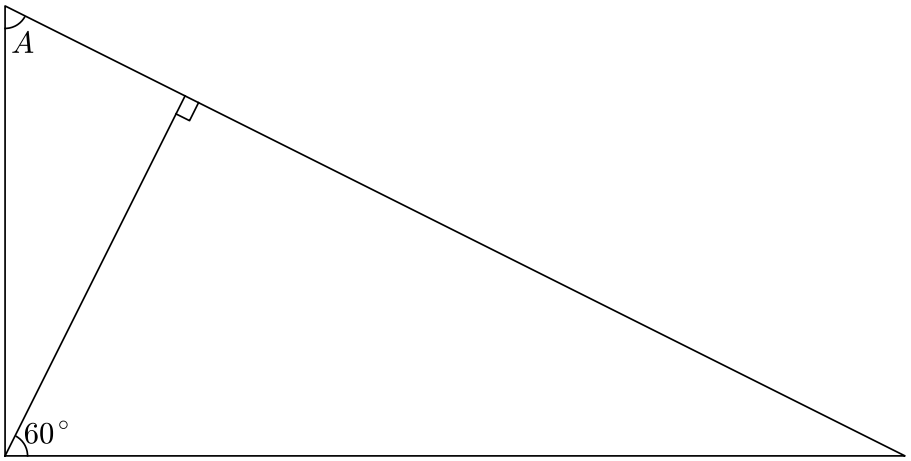
1204	726	861	90	180
$\times$ 5	$\div$ 66	$\div$ 7	$\times$ 2	$-$ 135

12	1107	12	825	14
$\times$ 12	$\div$ 9	$\times$ 8	$\div$ 5	$\times$ 14

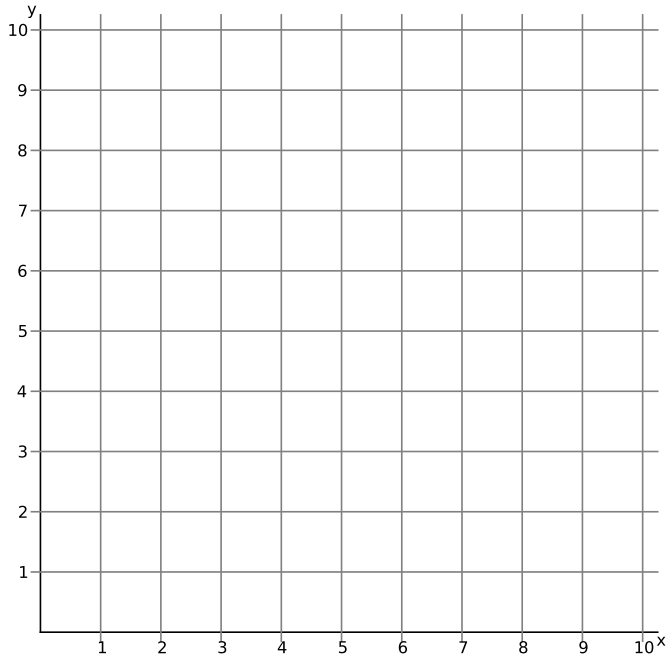
1. What is $\sqrt{49}$? What is $\sqrt{100}$?

   Use those answers to figure out $\sqrt{4900}$.

2. A right angle is 90 degrees. The sum of the three interior angles of a triangle is 180 degrees. There are also 180 degrees in a half-circle. Use these facts to figure out how many degrees angle A in the picture below has.



3. Draw a line through the points $(0, 3)$, $(1, 3)$, and $(3, 3)$. Can you find an equation for y in terms of x? (This would look like $y = a \times x + b$ where a and b are numbers.)



4131	476	204	90	180
$\times$ 4	$\div$ 7	$\div$ 3	$\times$ 3	$-$ 45

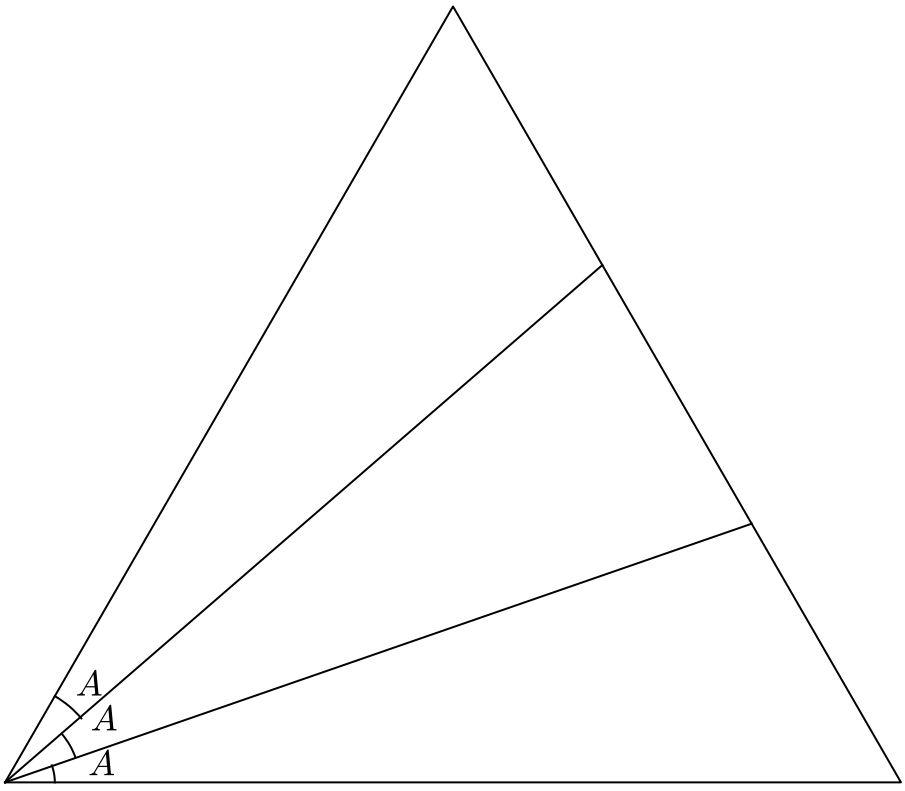
9	1107	12	748	68
$\times$ 12	$\div$ 9	$\times$ 8	$\div$ 11	$\times$ 5

1. If Bubu Bear is half the weight of Lulu Bear, and Lulu Bear is half the weight of GruGru Bear, and the total of their weights is 1400 pounds, how much does Bubu Bear weigh?

2. The big triangle below is equilateral and equilangular - all of its sides are the same length, and all of its interior angles are 60 degrees.

   This triangle is divided into three smaller triangles. The angles labeled A are all equal.

   Compute all of the interior angles of the smaller triangles.



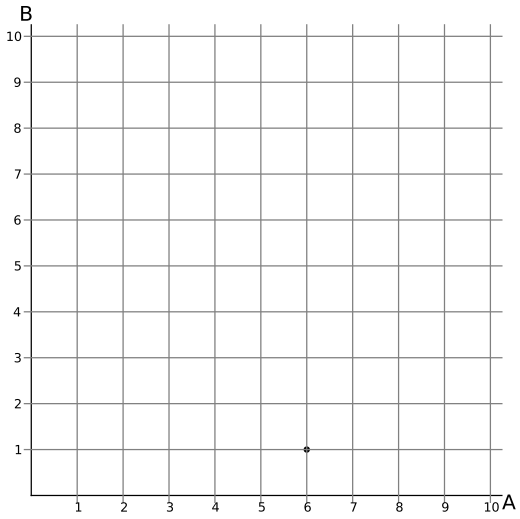
41×3	$1605 \div 5$	$205 \div 5$	90×12	60×5
12×6	$1926 \div 6$	12×4	$1098 - 777$	69×2

1. Is the average (mean) number of arms per person equal to 2, less than 2, or more than 2? (Careful!)

2. Suppose someone offers you the following bet: they will flip a coin, and if its heads, you lose 10 dollars. If its tails, you win 25 dollars. If you are sure the coin is fair, should you take the bet?

3. Which is larger, $\frac{1}{7}$ or $\frac{3}{20}$?

4. Draw some points (A, B) for which $B = A \times A - 10 \times A + 25$. One such point, $(6, 1)$, is already drawn. (Since $6 \times 6 - 10 \times 6 + 25 = 36 - 60 + 25 = 1$.)



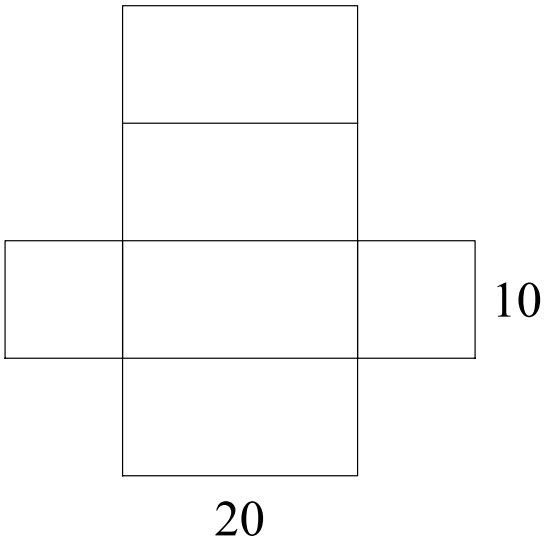
5×6	$100 \div 5$	$125 \div 5$	22×22	7×6
12×7	$216 \div 6$	6×6	$701 - 599$	70×7

1. Which is larger, 0.11 or $\frac{1}{10}$?

2. What is next in the sequence

$$1, 1, 2, 1, 2, 3, 1, 2, 3, 4, 1, 2, 3, 4, 5, \ldots$$

3. The volume of a rectangular box is the width $\times$ height $\times$ depth. If you folded up the pattern below into a box, what would its volume be?



6×3	$72 \div 4$	$345 \div 5$	17×17	7×8
12×6	$1296 \div 6$	8×9	$528 - 456$	13×7

1. How many interior angles of a quadrilateral can be acute?

2. What is $\frac{1}{3}$ divided by $\frac{1}{6}$?

3. What is the next number in the sequence below?

   $$1, \quad 4, \quad 9, \quad 16, \quad \_\_\_$$

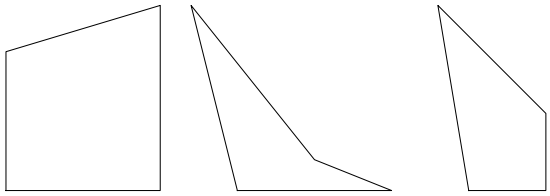
4. To change a temperature in Fahrenheit (F) to Celsius (C), the formula is

   $$C = \frac{9}{5} \times (F - 32)$$

   Use the formula to convert $-3F$ to Celsius.

16×3	$96 \div 4$	$200 \div 5$	19×19	21×21
9×7	$1029 \div 7$	18×4	$288 - 216$	14×7

1. How many interior angles of a quadrilateral can be acute? Some quadrilaterals are shown below (a quadrilateral has four straight sides).



2. What are the next two numbers in the sequence below?

$$2, \quad 5, \quad 10, \quad 17, \quad \_\_\_, \quad \_\_\_$$

3. To change a temperature in Fahrenheit (F) to Celsius (C), the formula is

$$C = \frac{9}{5} \times (F - 32)$$

For example, if the temperature in Fahrenheit is 37 degrees, then the temperature in Celsius is

$$\frac{9}{5} \times (37 - 32) = \frac{9}{5} \times 5 = 9$$

What is the temperature in Celsius if it is 42 Fahrenheit?

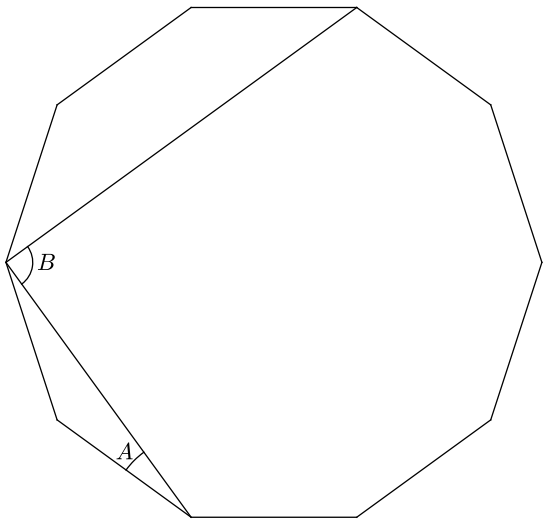
16×5	$57 \div 3$	$325 \div 5$	15×15	102×51
202×7	$511 \div 7$	18×3	$862 - 789$	73×3

1. Write a Scratch program that asks for a temperature in Fahrenheit, and then tells you the corresponding temperature in Celsius. (Remember, first subtract 32 from the Fahrenheit temperature, and then multiply by 5/9.)

2. What are the next two numbers in the sequence below?

   1, 9, 25, 49, ___, ___

3. Below is a regular decagon (10 sides of equal length and equal angles between them). Two additional line segments between some vertices have been added. The angle A is eighteen degrees. How many degrees is angle B?



37×2	$222 \div 3$	$125 \div 5$	225×4	74×5

10203×7	$423 \div 9$	15×3	$273 - 199$	75×3

1. Every whole number can be written as a sum of powers of two (i.e. $1, 2, 4, 8, 16, 32, 64, \ldots$) using each power of two at most once. For example,

   $$39 = 32 + 4 + 2 + 1$$

   Decompose the following numbers in a similar way:

   a) $11 =$ __ + __ + __

   b) $66 =$ __ + __

   c) $28 =$ __ + __ + __

2. What are the next two numbers in the sequence below?

   1, 5, 17, 37, ___, ___

37.5×2	$225 \div 3$	$375 \div 5$	75×4	$75 \div 25$
12×7	$57 \div 3$	9×8	$1001 - 9$	15×5

1. Every whole number can be written as a sum of powers of two (i.e. $1, 2, 4, 8, 16, 32, 64, \ldots$) using each power of two at most once. For example,

   $$39 = 32 + 4 + 2 + 1$$

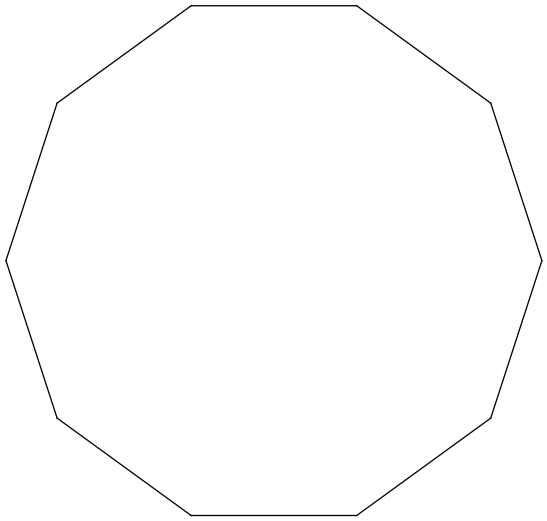
   Decompose the following numbers in a similar way:

   a) $7 =$

   b) $15 =$

   c) $31 =$

2. Draw a five pointed star using the decagon below (the tips of the star should be on vertices of the decagon).



0.125×8	$246 \div 3$	$875 \div 5$	75×6	$250 \div 25$
12×9	$570 \div 3$	9×9	$1010 - 101$	32×4

1. Every whole number can be written as a sum of powers of two (i.e. $1, 2, 4, 8, 16, 32, 64, \ldots$) using each power of two at most once. For example,

   $$39 = 32 + 4 + 2 + 1$$

   Because of this property, just as the decimal system uses powers of ten, we can use powers of two to write numbers in *binary*. We can write 39 as:

   $$39 = \underline{1} \times 32 \ + \ \underline{0} \times 16 \ + \ \underline{0} \times 8 \ + \ \underline{1} \times 4 \ + \ \underline{1} \times 2 \ + \ \underline{1} \times 1$$

   so in binary, 32 is written as 100111. To make it clear that it is in binary, we can write it as 100111_2.

   Here is another example: since 8 is a power of two, its binary representation is just 1000_2 - it is one eight, zero fours, zero twos, and zero ones.

   Convert the following binary numbers to decimals.

   a) $10_2 =$

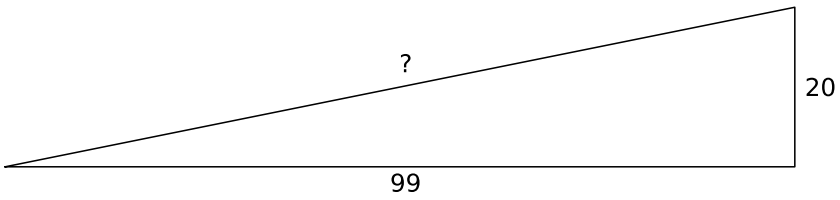
   b) $100_2 =$

   c) $101_2 =$

101×101	8×8	15×15	$64 + 225$	17×17
9×9	40×40	41×41	$81 + 1600$	$1573 \div 11$

1. Vinny 'The Mole' Lagardi has a plan. A plan to rob a bank. But to do it, he needs your help. He promises you 20% of the loot if you can.

   Vinny has rented a building near the bank, one with a deep basement. Vinny knows that the wall of the basement is 99 meters west of the bank and 20 meters south. He needs to know exactly how far to tunnel if he digs a straight line towards the bank. He dimly remembers something from school that might help, 'da Pittagory tea-room'? How far should Vinny dig?

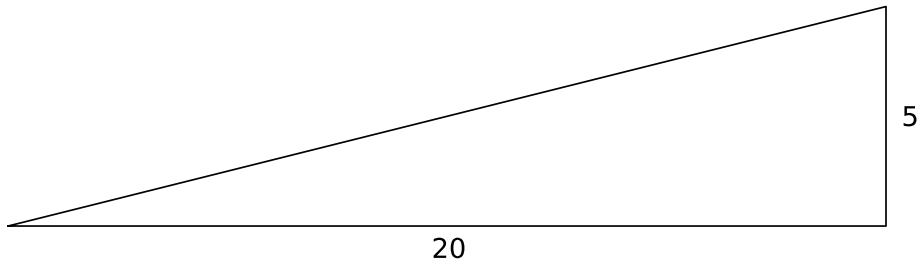


2. Vinny successfully breaks into the vault of the bank and steals $95,381$ dollars. He gives you $21,000$ dollars. Is Vinny giving you your fair share of 20%?

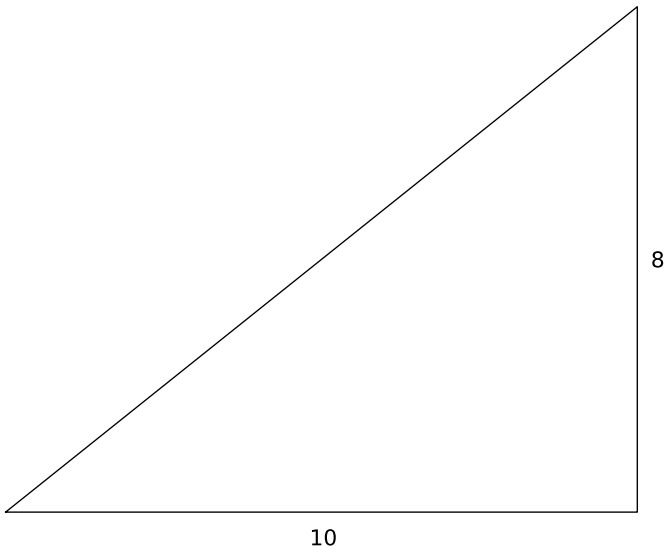
80×0.5	9×8	14×13	$430 - 149$	18×18
6×6	88×5	44×5	22×5	$187 \div 11$

1. The area of a right triangle is one-half the base length times the height. For example, the area of the triangle below is

$$\frac{1}{2} \times 5 \times 20 = \frac{1}{2} \times 100 = 50$$



What is the area of this triangle?



$80 \div 8$	$144 \div 12$	$169 \div 13$	$100 - 36$	16×16

$36 \div 6$	$88 \div 11$	$625 \div 25$	$102 \div 3$	(careful!) 0.5×0.5

1. Yesterday you learned that the area of a right triangle is one half times the base times the height. Calculate the area of the big triangle below by adding together the areas of the two smaller right triangles inside of it.