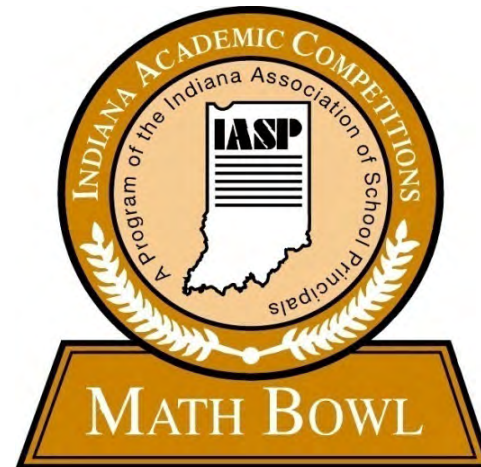


**PURDUE**  
UNIVERSITY

**Indiana Academic  
M.A.T.H. Bowl**



**Area 2021**



Begin  
Practice  
Round



$$20 - 20 = ?$$

A. 20

B. 22

C. 0

D. 40

$$20 - 20 = ?$$

C. 0

End  
Practice  
Round

Begin  
Round  
One



Simplify  $30 + 5 \div 5 \times 81 =$

- A. 567
- B. 2,430
- C. 111
- D. 101



Simplify  $30 + 5 \div 5 \times 81 =$

C. 111

Order of operations tells us to multiply and divide left to right first.

$$30 + (5 \div 5) \times 81$$

$$30 + 1 \times 81$$

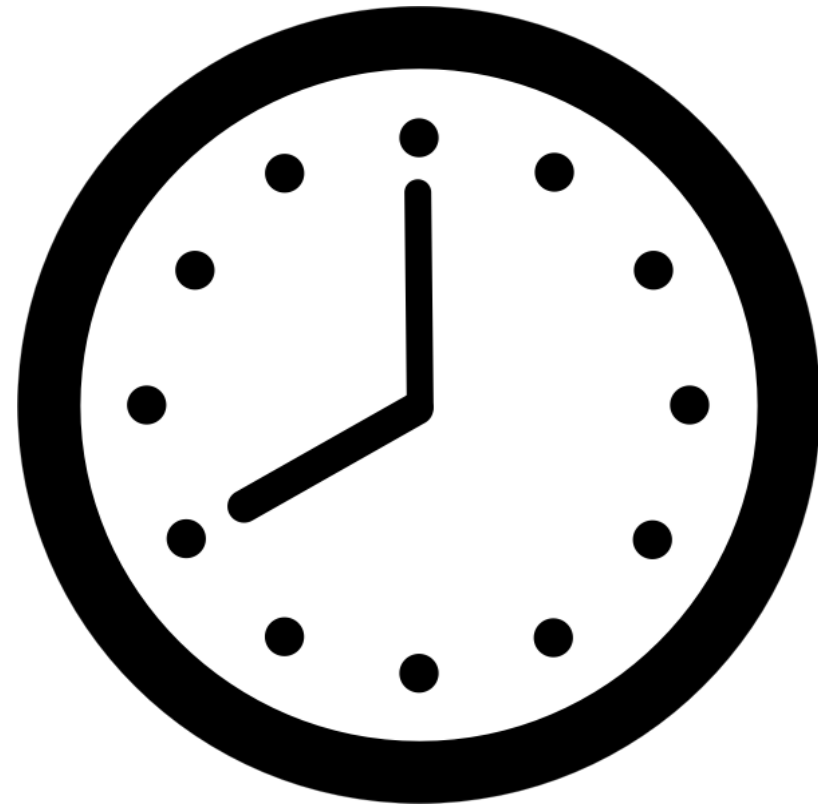
$$30 + 81$$

$$111$$



How many seconds are in 2.75 hours?

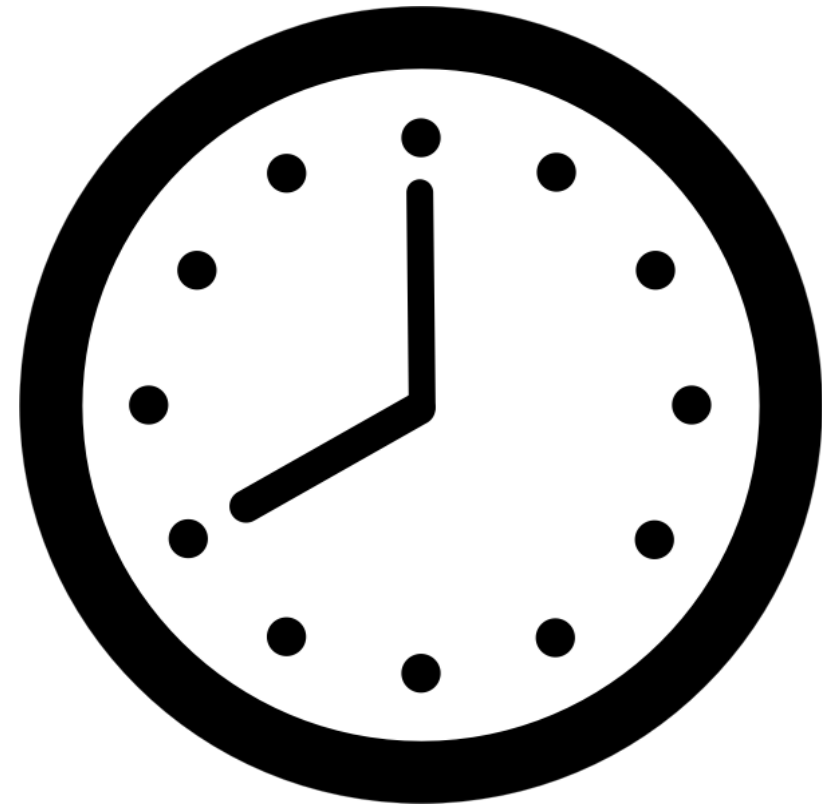
- A. 3,333 seconds
- B. 4,443 seconds
- C. 5,594 seconds
- D. 9,900 seconds



# How many seconds are in 2.75 hours?

D. 9,900 seconds

$2.75 \text{ hours} \times 60 \text{ minutes per hour} = 165 \text{ minutes}$   
 $165 \text{ minutes} \times 60 \text{ seconds per minute} = 9,900 \text{ seconds}$



Victoria is trying to save her money. She starts with \$50. Then she puts in an equal amount once a month. Two months later, she has \$90. If the process continues, how much will she have in one year?

- A. \$275
- B. \$290
- C. \$300
- D. \$320



Victoria is trying to save her money. She starts with \$50. Then she puts in an equal amount once a month. Two months later, she has \$90. If the process continues, how much will she have in one year?

B. \$290

$\$90 - \$50 = \$40$  saved in two months

$\$40 \div 2 = \$20$  per month in savings

$\$20$  per month for 12 months = \$240 in savings in a year

$\$50 + \$240 = \$290$  total for the year



Emma is making a trail mix that calls for the extended ratio (using cups) of peanuts to raisins to pretzels that is 2:4:3, in that order. This recipe makes 18 servings. How many cups of raisins are needed for Emma to make enough for 27 servings?

- A. 6 cups
- B. 5 cups
- C. 8 cups
- D.  $4\frac{1}{2}$  cups



Emma is making a trail mix that calls for the extended ratio (using cups) of peanuts to raisins to pretzels that is 2:4:3, in that order. This recipe makes 18 servings. How many cups of raisins are needed for Emma to make enough for 27 servings?

A. 6 cups

We can use a proportion or simple reasoning.

4 cups of raisins in 18 servings.

2 cups of raisins in 9 servings.

6 cups of raisins in 27 servings.





The ratio of boys to girls on a soccer team is 3:4. If there are 49 players on a team, how many are girls?

- A. 24
- B. 18
- C. 28
- D. 16



The ratio of boys to girls on a soccer team is 3:4. If there are 49 players on a team, how many are girls?

C. 28

Girls	Boys	Ratio of boys:girls	Is it 3:4?
24	$49 - 24 = 25$	25:24	no
18	$49 - 18 = 31$	31:18	no
28	$49 - 28 = 21$	21:28	yes
16	$49 - 16 = 33$	33:16	no



We could also use a proportion. Look at the number of girls listed. Only one gives more girls than boys.

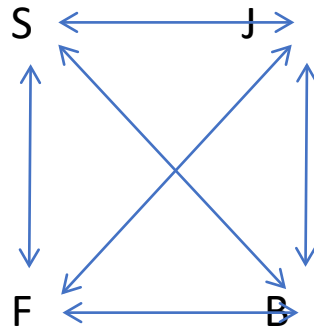
Four basketball teams, the Stars, Jackets, Farmers, and Bearcats have one game against each other. Each team plays against every other team in one game only. How many games are played?

- A. 4 games
- B. 6 games
- C. 8 games
- D. 10 games



Four basketball teams, the Stars, Jackets, Farmers, and Bearcats have one game against each other. Each team plays against every other team in one game only. How many games are played?

B. 6 games



Stars vs Jackets  
Stars vs Farmers  
Stars vs Bearcats  
Jackets vs Farmers  
Jackets vs Bearcats  
Farmers vs Bearcats



A pile of 68 coins consists of quarters and dimes. If the value of the pile is \$15.05, how many dimes are there?

- A. 13 dimes
- B. 55 dimes
- C. 11 dimes
- D. 12 dimes



A pile of 68 coins consists of quarters and dimes. If the value of the pile is \$15.05, how many dimes are there?

A. 13 dimes

Let  $x$  = number of dimes

$68 - x$  = number of quarters

$$10x + 25(68 - x) = 1505$$

$$10x + 1700 - 25x = 1505$$

$$-15x + 1700 = 1505$$

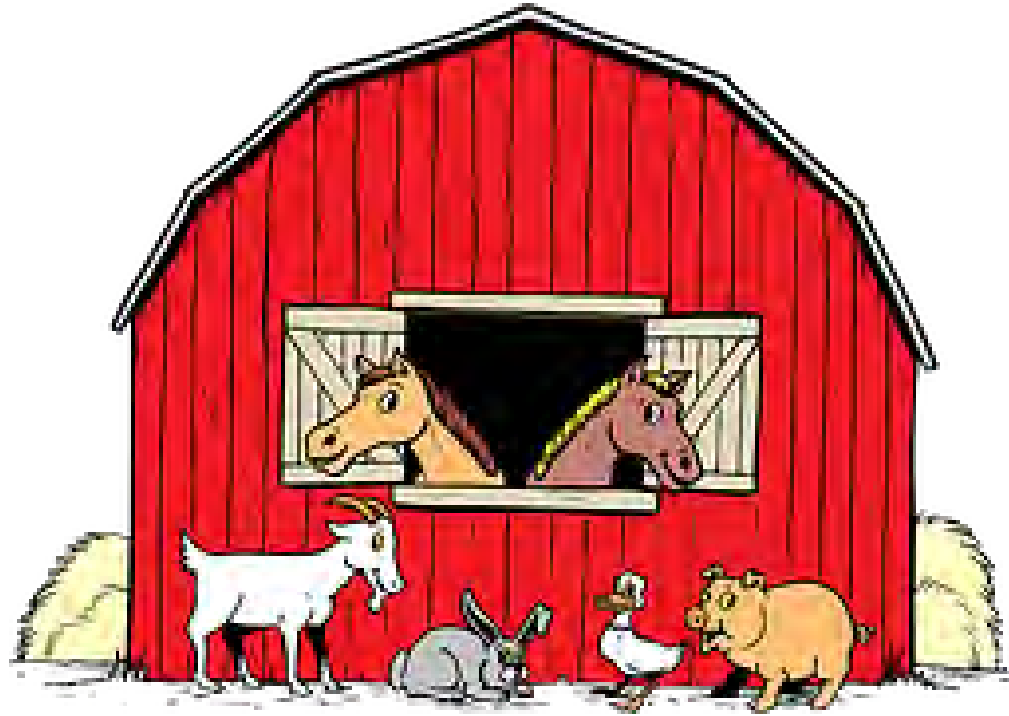
$$195 = 15x$$

$$x = 13$$



A group of ducks and cows are in a field. There are a total of 72 heads and 196 legs. How many ducks are in the field?

- A. 32 ducks
- B. 26 ducks
- C. 56 ducks
- D. 46 ducks





A group of ducks and cows are in a field. There are a total of 72 heads and 196 legs. How many ducks are in the field?

D. 46 ducks

By checking each answer:

- A. 32 ducks, 20 cows  $\rightarrow 32(2) + 20(4) = 144$  legs
- B. 26 ducks, 46 cows  $\rightarrow 26(2) + 46(4) = 236$  legs
- C. 56 ducks, 16 cows  $\rightarrow 56(2) + 16(4) = 176$  legs
- D. 46 ducks, 26 cows  $\rightarrow 46(2) + 26(4) = 196$  legs

By solving algebraic equations

Let  $d$  = number of ducks

Let  $c$  = number of cows

$$d + c = 72 \text{ heads} \rightarrow c = 72 - d$$

$$2d + 4c = 196 \text{ legs}$$

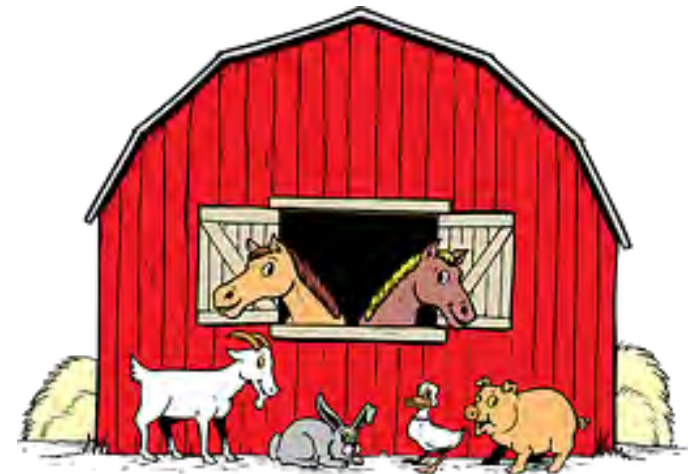
$$2d + 4(72 - d) = 196$$

$$2d + 288 - 4d = 196$$

$$288 - 2d = 196$$

$$92 = 2d$$

$$d = 46$$





End  
Round  
One

Begin  
Round  
Two

Which of the following is the same as 21%?

- A. 0.021
- B.  $\frac{1}{5}$
- C.  $\frac{3}{7}$
- D. 0.21



Which of the following is the same as 21%?

D. 0.21

Percent (%) means divide by 100.  
21 percent is 21 hundredths or 0.21.



Clayton attends basketball practice for 1 hour each weekend and then 2 hours during the week. How many minutes will he practice in 4 weeks?

- A. 240 minutes
- B. 480 minutes
- C. 720 minutes
- D. 1,540 minutes



Clayton attends basketball practice for 1 hour each weekend and then 2 hours during the week. How many minutes will he practice in 4 weeks?

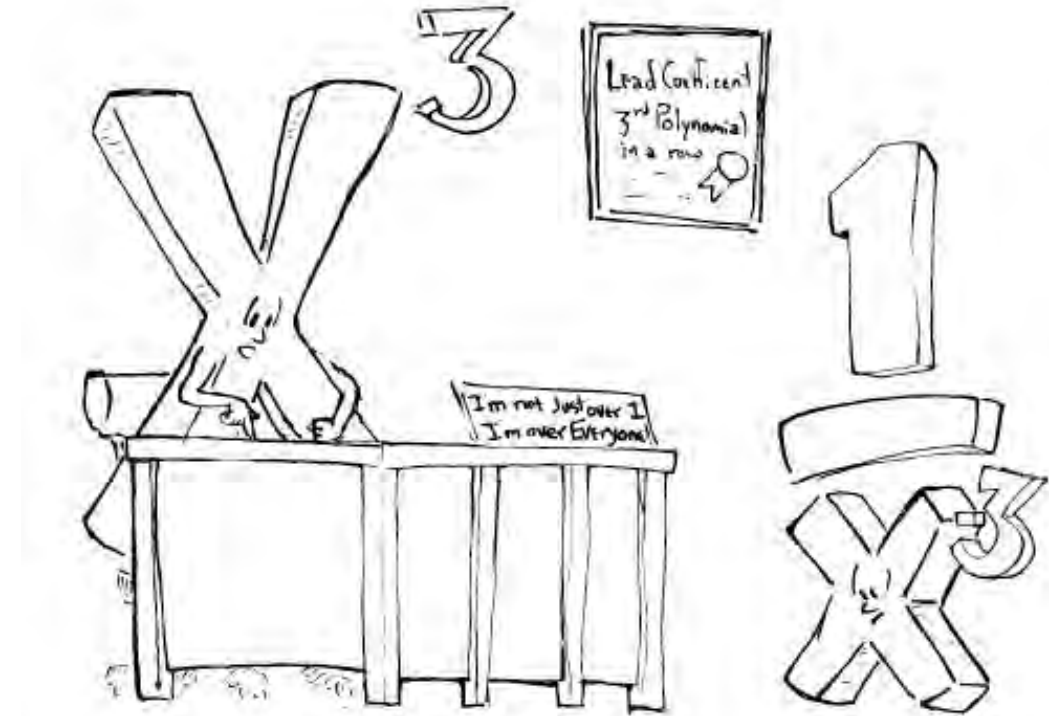
C. 720 minutes

$1 + 2 = 3$  hours of practice per week  
 $3 \times 4 = 12$  hours in 4 weeks  
 $12 \times 60 = 720$  minutes in 4 weeks



Simplify  $6^3 / (2)^2(6)$

- A. 0
- B. 1
- C. 6
- D. 9



Mark my words! You harness that negative power of yours,  
and you can make it to the top just like me!

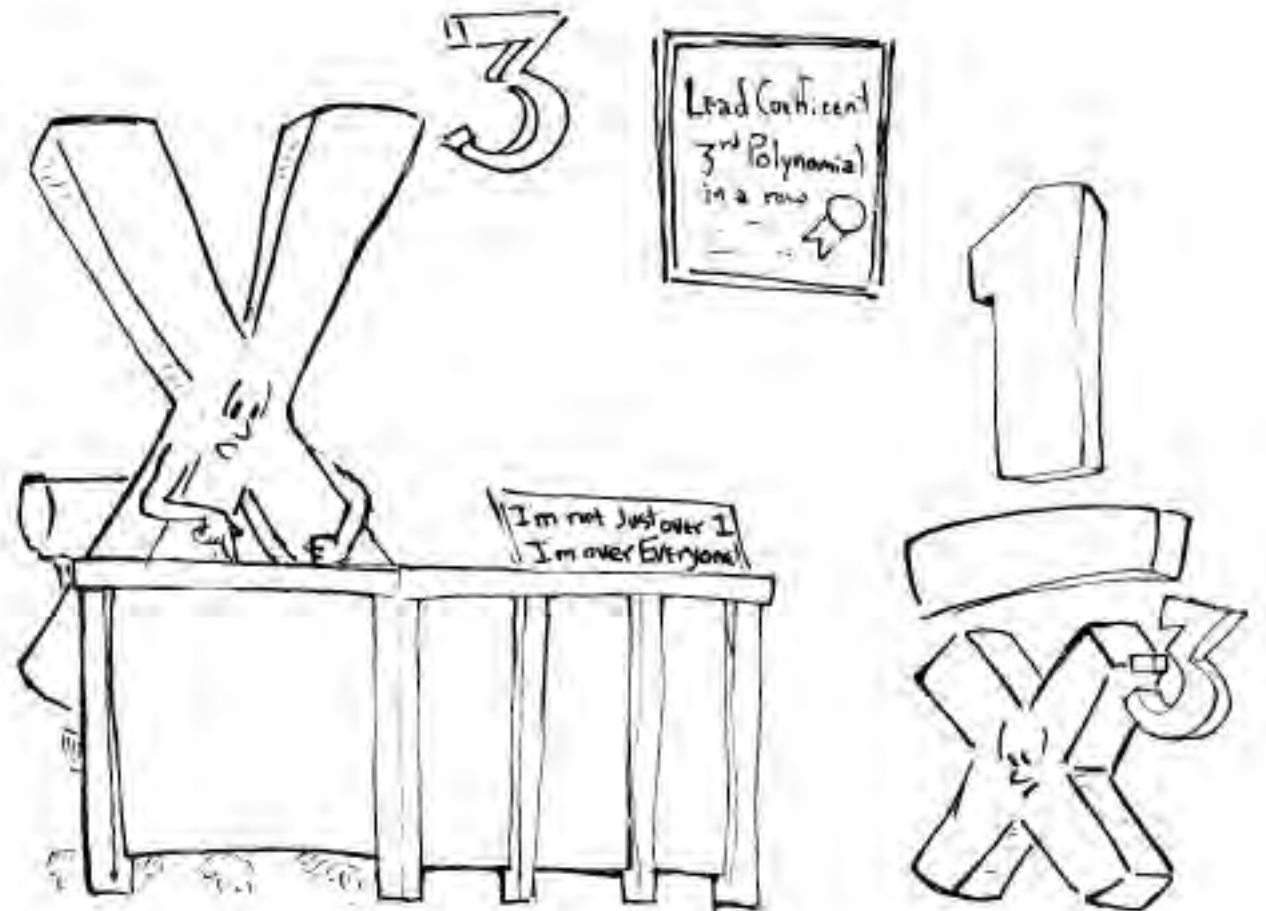
Simplify  $6^3 / (2)^2(6)$

D. 9

$$\frac{6(6)(6)}{2(2)(6)}$$

$$\frac{36}{4}$$

9

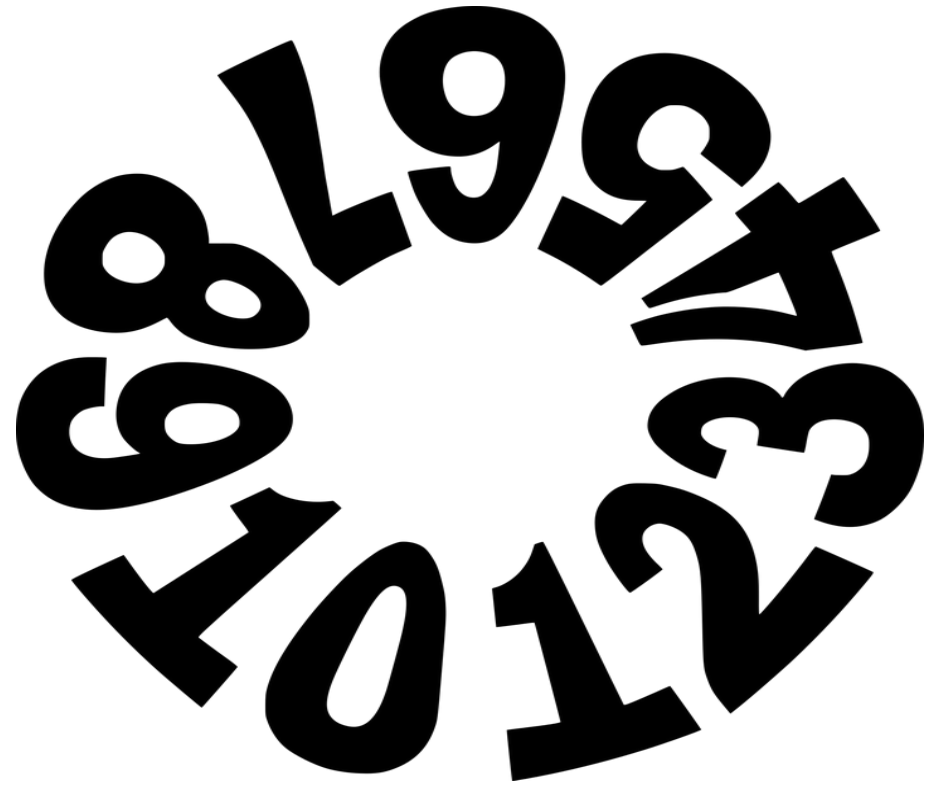


Mark my words! You harness that negative power of yours,  
and you can make it to the top just like me!



What is the sixth whole number factor of 144, counting from least to greatest?

- A. 2
- B. 4
- C. 6
- D. 8

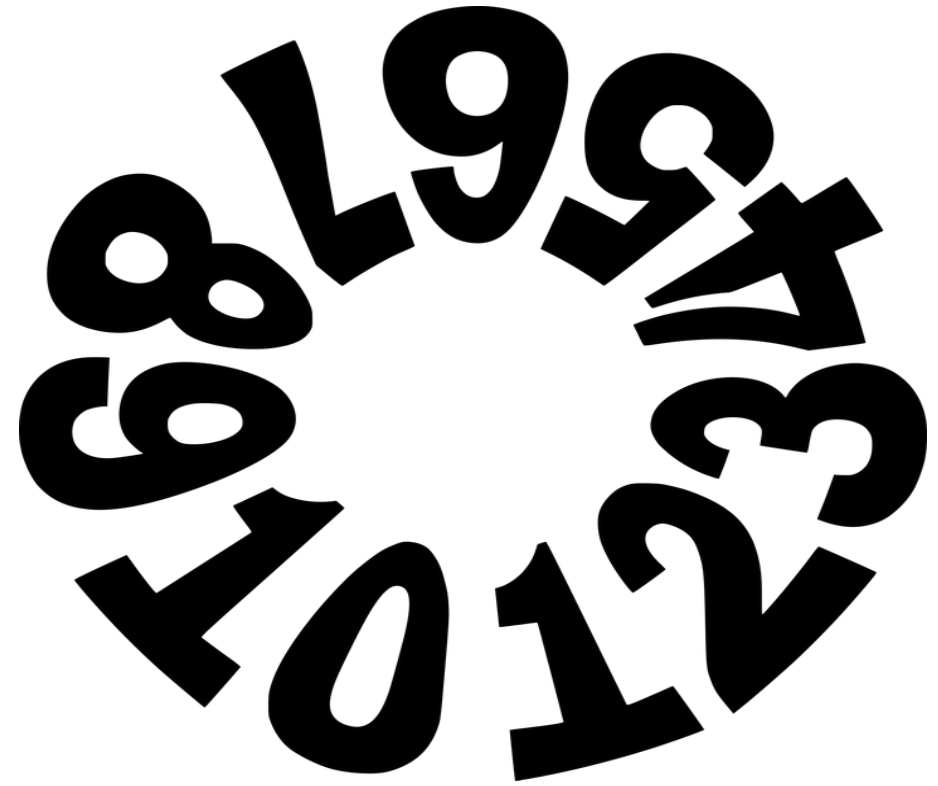


What is the sixth whole number factor of 144, counting from least to greatest?

D. 8

The factors of 144 listed in order from least to greatest:

1, 2, 3, 4, 6, 8, 9, 12, 16, 18, 24, 36, 48, 62, 144



A rectangular flag has a perimeter of 60 cm and length of 20 cm. What is the area of this rectangular flag?

- A. 200 sq cm
- B. 20 sq cm
- C. 100 sq cm
- D. 10 sq cm



A rectangular flag has a perimeter of 60 cm and length of 20 cm. What is the area of this rectangular flag?

A. 200 sq cm

$$\begin{aligned}P &= 2L + 2W \\60 &= 2(20) + 2W \\60 &= 40 + 2W \\20 &= 2W \\10 &= W\end{aligned}$$

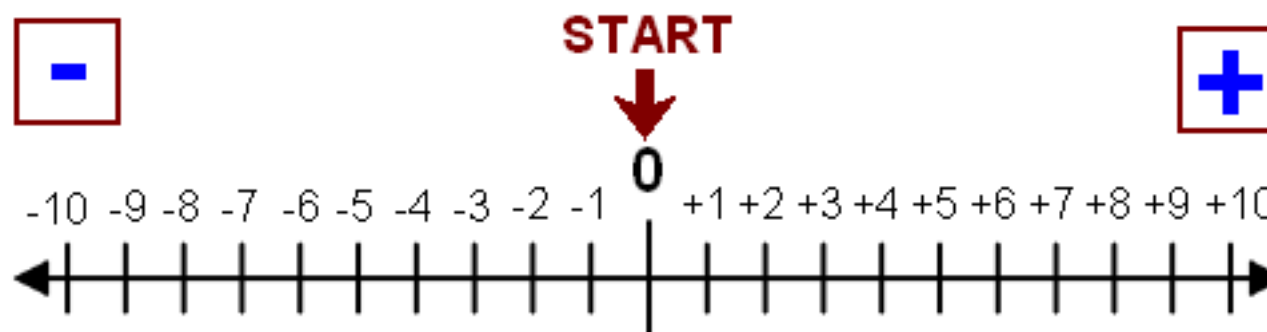
$$\begin{aligned}A &= LW \\A &= 20(10) \\A &= 200\end{aligned}$$



What is the value of

$$4 + -6 + 4 - -6 + 4 + (-4 + 5) - -2?$$

- A. 0
- B. 31
- C. -2
- D. 15

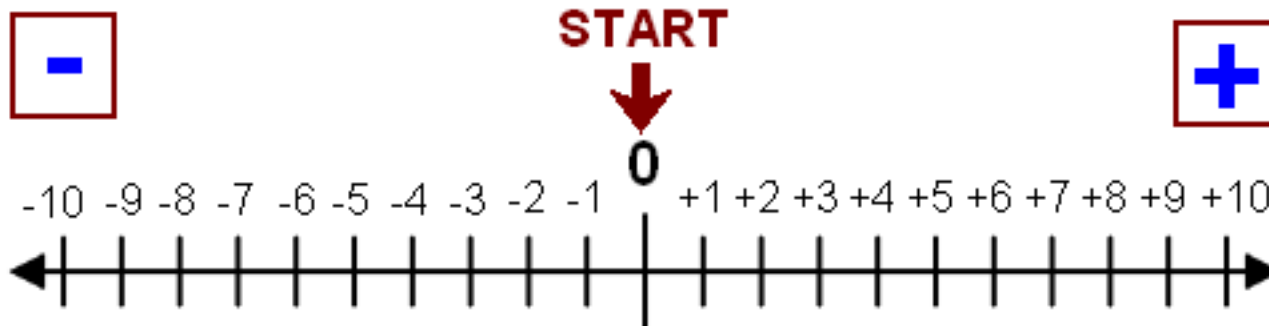


What is the value of

$$4 + -6 + 4 - -6 + 4 + (-4 + 5) - -2?$$

D. 15

$$\begin{aligned} &4 + -6 + 4 - -6 + 4 + (-4 + 5) - -2 \\ &4 + -6 + 4 - -6 + 4 + (1) - -2 \\ &-2 + 4 - -6 + 4 + (1) - -2 \\ &2 - -6 + 4 + (1) - -2 \\ &2 + 6 + 4 + (1) - -2 \\ &8 + 4 + (1) - -2 \\ &12 + (1) - -2 \\ &13 - -2 \\ &13 + 2 \\ &15 \end{aligned}$$



A broken clock loses 4 minutes every hour. If the broken clock and a normal clock are both set at noon, what time will the normal clock say when the broken clock reads 2:20 PM?

- A. 2:26 PM
- B. 2:30 PM
- C. 2:32 PM
- D. 2:34 PM



A broken clock loses 4 minutes every hour. If the broken clock and a normal clock are both set at noon, what time will the normal clock say when the broken clock reads 2:20 PM?

Using a proportion, broken : normal, gives 56:60 minutes each hour.

**B. 2:30 PM**

2:20 is 140 minutes later on the broken clock.

Let  $x$  = number of minutes later on the normal clock.

$$\frac{56}{60} = \frac{140}{x}$$

$$56x = 60(140)$$

$$56x = 8400$$

$$x = 150 \text{ or } 150 \text{ minutes after noon, which is } 2:30 \text{ PM}$$



Another solution: the broken clock advances 14 minutes each time the normal advances 15 minutes. At 2:20, it has advanced 10 times. So  $10(15 \text{ minutes}) = 150 \text{ minutes later on the normal clock or } 2:30$ .



The number 24 written in Base 5 is  $44_5$  because there are 4 fives and 4 ones. The number 47 written in Base 5 is  $142_5$  because there is 1 twenty-five, 4 fives and 2 ones. How would you write the number 36 in Base 5?

- A.  $71_5$
- B.  $120_5$
- C.  $121_5$
- D.  $403_5$



The number 24 written in Base 5 is  $44_5$  because there are 4 fives and 4 ones. The number 47 written in Base 5 is  $142_5$  because there is 1 twenty-five, 4 fives and 2 ones. How would you write the number 36 in Base 5?

In Base 5, the place values are  $5^2$ ,  $5^1$ ,  $5^0$  or the number of 25s, 5s, and ones. Only the digits 0, 1, 2, 3, and 4 are used.

$$36 = 25 + 2(5) + 1.$$

C.  $121_5$



End  
Round  
Two

Begin  
Round  
Three

Kylie is planting vegetables in her garden. The first row is corn, the second row is beans, and the third row is cucumbers. If she repeats the same pattern, what vegetable is in the tenth row?

- A. Corn
- B. Beans
- C. Cucumbers
- D. Beets



Kylie is planting vegetables in her garden. The first row is corn, the second row is beans, and the third row is cucumbers. If she repeats the same pattern, what vegetable is in the tenth row?

A. Corn

- 1 Corn
- 2 Beans
- 3 Cucumbers
- 4 Corn
- 5 Beans
- 6 Cucumbers
- 7 Corn
- 8 Beans
- 9 Cucumbers
- 10 Corn



What is 20% of 2?

- A. 4
- B. 40
- C. 0.4
- D. 0.04



# What is 20% of 2?

C. 0.4

20% of 2  
 $0.20(2)$   
0.40 or 0.4





Solve for A:

$$(10/2) + (A + 3) = 40$$

- A.  $A = 5$
- B.  $A = 8$
- C.  $A = 32$
- D.  $A = 35$



Solve for A:

$$(10/2) + (A + 3) = 40$$

C.  $A = 32$

$$(10/2) + (A + 3) = 40$$

$$5 + A + 3 = 40$$

$$A + 8 = 40$$

$$A + 8 - 8 = 40 - 8$$

$$A = 32$$



According to the census, the population of a country increased by an average of 2% per year. If the population of this country was 2,000,000 on December 31, 2018, what would the population of this country have been on January 1, 2017?

- A. 2,040,000
- B. 1,960,784
- C. 1,666,667
- D. 1,999,998



According to the census, the population of a country increased by an average of 2% per year. If the population of this country was 2,000,000 on December 31, 2018, what would the population of this country have been on December 31, 2017?

B. 1,960,784

Let  $x$  = 2017 population  
 $0.02x + x$  = 2018 population

$$0.02x + x = 2,000,200$$

$$1.02x = 2,000,000$$

$$x = 2,000,000/1.02$$

$$x = 1,960,784$$



The price of a book after a 15% discount is \$34. What was the original price of the book?

- A. \$40
- B. \$42
- C. \$38
- D. \$36



The price of a book after a 15% discount is \$34. What was the original price of the book?

A. \$40

Let  $x$  = original price of book

If we get a 15% discount, we pay 85% of the original price.

$$85\% \text{ of } x = 34.$$

$$0.85x = 34$$

$$x = 34/0.85$$

$$x = 40$$



A carpenter cut a 24 foot board into three pieces. The longest piece is 5 feet longer than the shortest piece. If the remaining piece is 4 feet shorter than the longest piece, how long is the remaining board?

- A. 7 feet
- B. 2 yards
- C. 8 feet
- D. 5 feet





A carpenter cut a 24 foot board into three pieces. The longest piece is 5 feet longer than the shortest piece. If the remaining piece is 4 feet shorter than the longest piece, how long is the remaining board?

A. 7 feet

Let  $x$  = longest length  
 $x - 5$  = shortest length  
 $x - 4$  = middle length

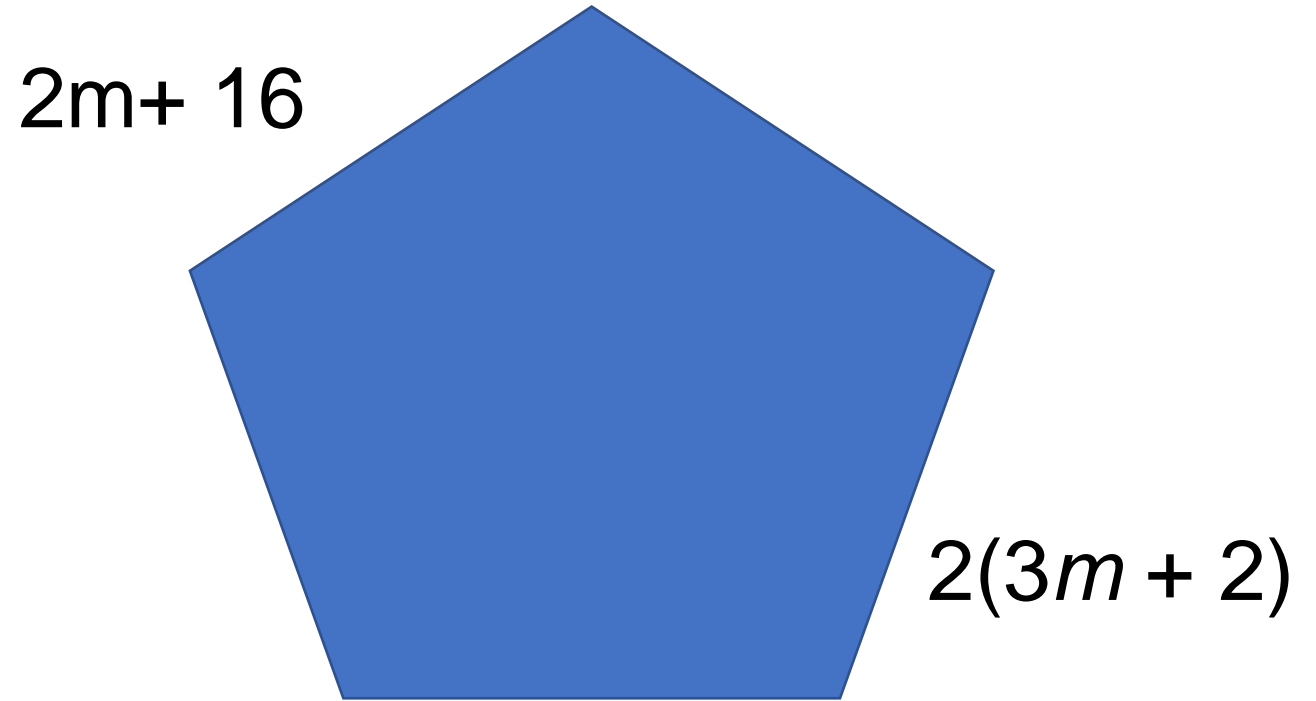
$$\begin{aligned}x + (x - 5) + (x - 4) &= 24 \\3x - 9 &= 24 \\3x - 9 + 9 &= 24 + 9 \\3x &= 33 \\3x/3 &= 33/3 \\x &= 11 \\x - 4 &= 7 \text{ feet}\end{aligned}$$





The polygon pictured is a regular pentagon where all the sides are the same length. What is the perimeter?

- A. 3 units
- B. 22 units
- C. 132 units
- D. 110 units



The polygon pictured is a regular pentagon where all the sides are the same length. What is the perimeter?

D. 110 units

$$2m + 16$$

$$2m + 16 = 2(3m + 2) \text{ because sides are all same length}$$

$$2m + 16 = 6m + 4$$

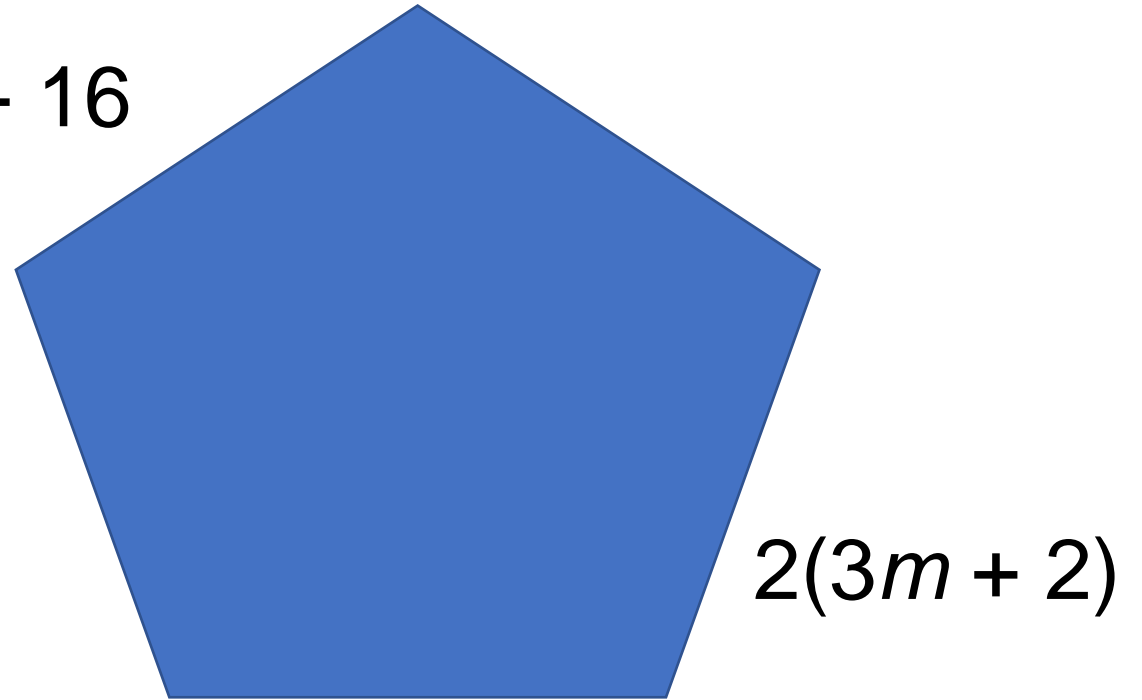
$$16 = 4m + 4$$

$$12 = 4m$$

$$m = 3$$

$$2m + 16 \text{ then equals } 2(3) + 16 \text{ or } 22.$$

$$\text{The perimeter is the total distance around or } 5(22) = 110.$$



$$\square \times \square \times \square = 27$$

$$\triangle \times \triangle \times \triangle \times \square = 24$$

$$\square \times \triangle \times \bigcirc \times \bigcirc = 96$$

$$\bigcirc + \square \times \triangle = ?$$

- A. 14
- B. 24
- C. 12
- D. 10

$$\square \times \square \times \square = 27$$

$$\triangle \times \triangle \times \triangle \times \square = 24$$

$$\square \times \triangle \times \bigcirc \times \bigcirc = 96$$

$$\bigcirc + \square \times \triangle = ?$$

Square = 3  
Triangle = 2  
Circle = 4

$$4 + 3 \times 2 = 4 + 6$$

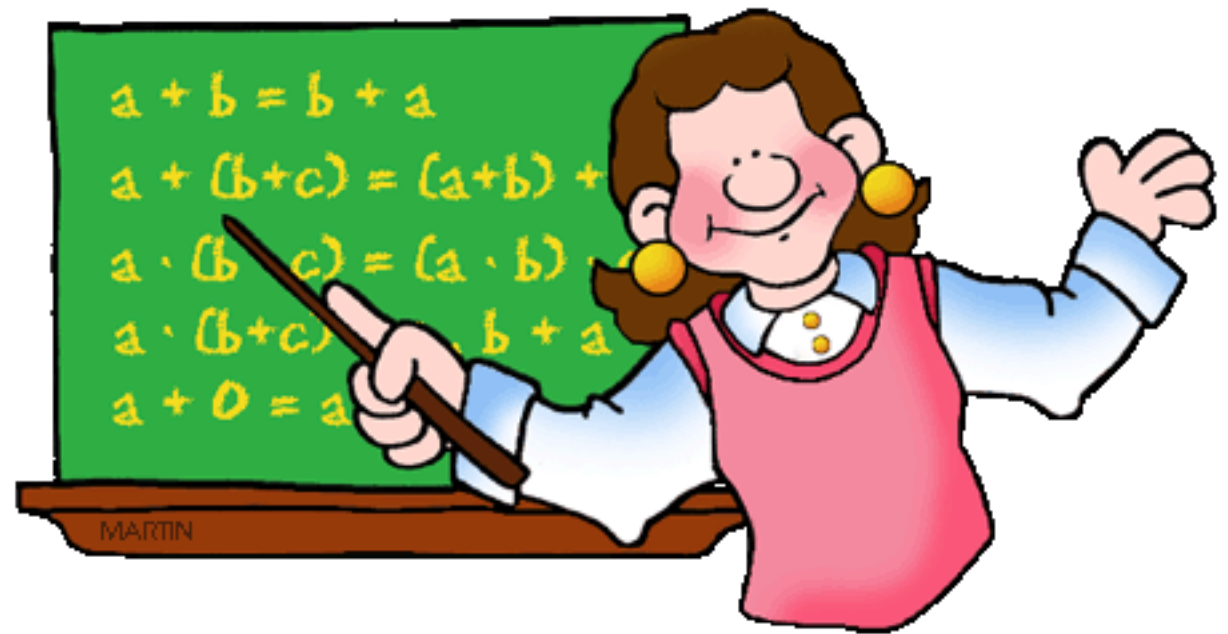
D. 10

End  
Round  
Three

Begin  
Round  
Four

Solve  $x + 9 = 45$

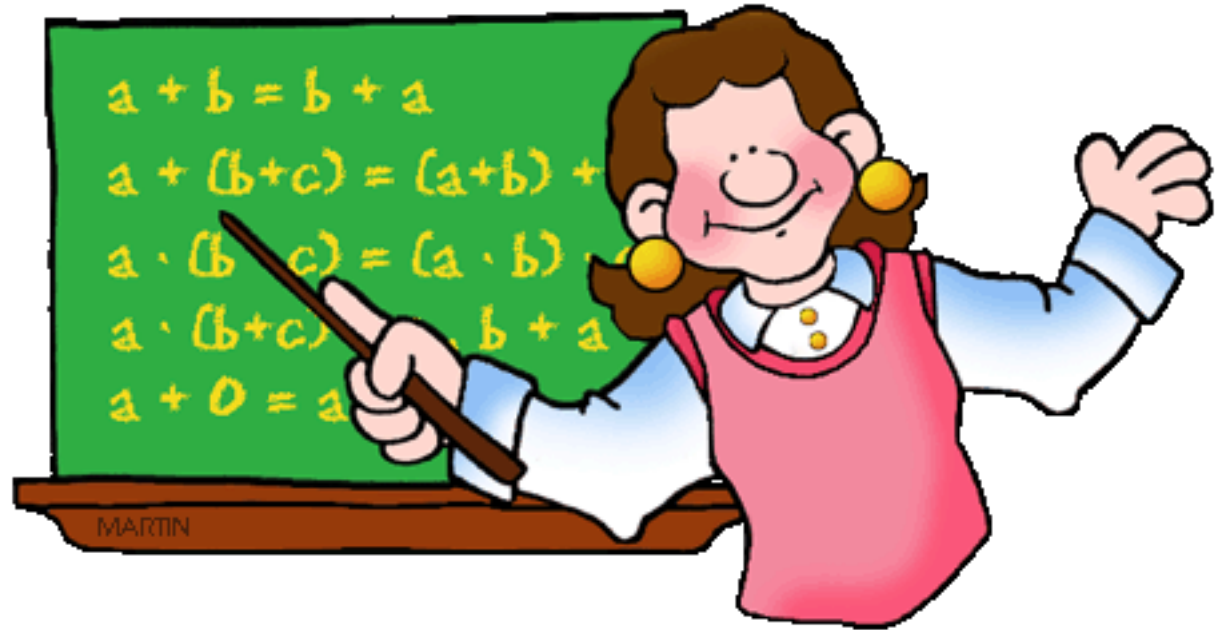
- A.  $x = 54$
- B.  $x = 5$
- C.  $x = 36$
- D.  $x = 405$



Solve  $x + 9 = 45$

C.  $x = 36$

$$\begin{aligned}x + 9 &= 45 \\x + 9 - 9 &= 45 - 9 \\x &= 36\end{aligned}$$





In the number 2021, the sum of the digits is five.  
This information tells us:

- A. 2021 is not divisible by 5
- B. 2021 is not divisible by 2
- C. 2021 is a composite number
- D. 2021 is not divisible by 3 or 9



In the number 2021, the sum of the digits is five.  
This information tells us:

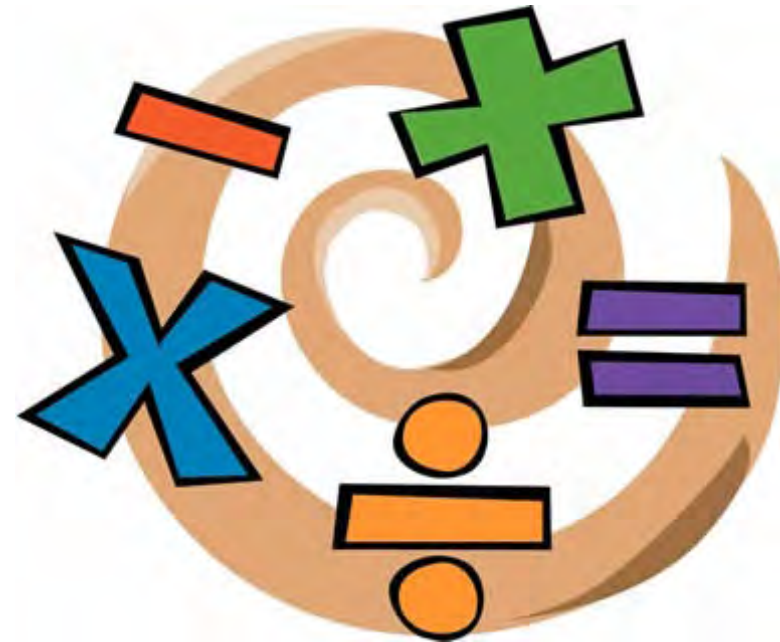
D. 2021 is not divisible by 3 or 9



All statements A-D are all true but only D uses the information in the question about the sum of the digits.  
Only the last digit is needed to test for divisibility by 2 and 5.  
The factors of 2021 are 1, 43, 47, and 2021.  
If the sum of the digits is divisible by 3 then so is the number.  
Similarly, if the sum of the digits is divisible by 9, so is the number.

Find the least common multiple of 5, 8, and 10.

- A. 1
- B. 5
- C. 40
- D. 80

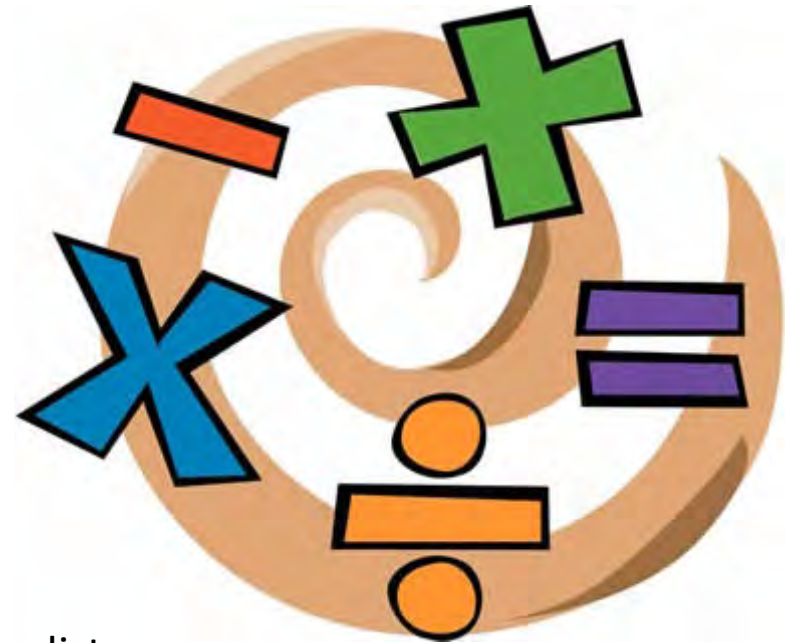


Find the least common multiple of 5, 8, and 10.

C. 40

First we list the multiples of each number  
5, 10, 15, 20, 25, 30, 35, **40**, 45, 50, ...  
8, 16, 24, 32, **40**, 48, 56, 64, 71, 80, ...  
10, 20, 30, **40**, 50, 60, 70, 80, ...

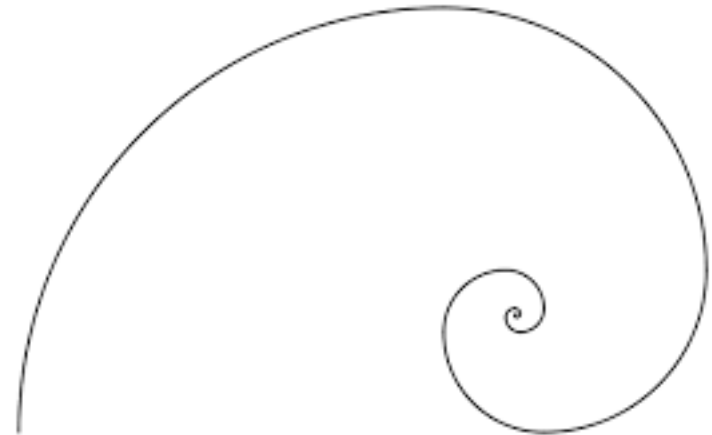
Then we look for the smallest multiple in all three lists.



What are the next three numbers in this sequence?

2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233...

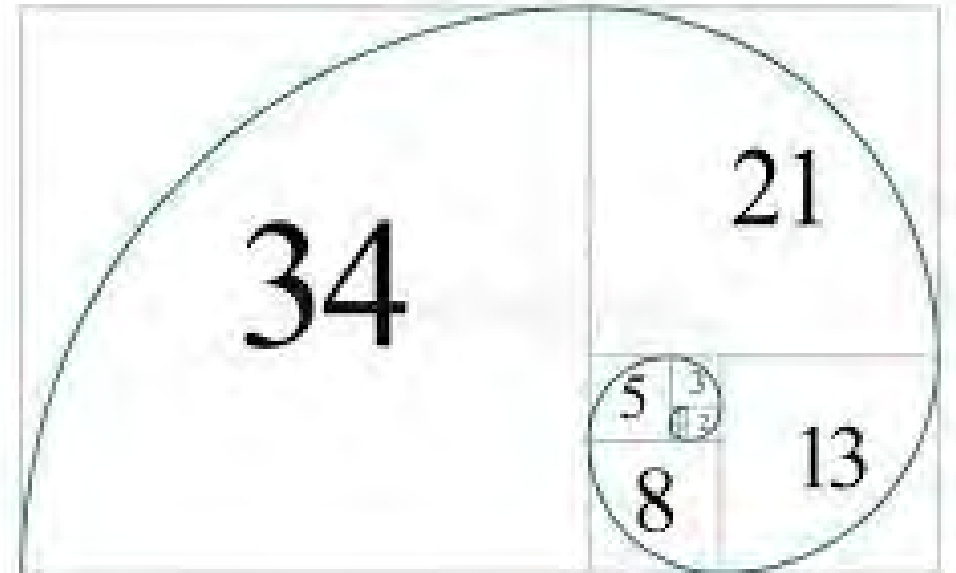
- A. 368, 491, 903
- B. 377, 600, 977
- C. 366, 499, 610
- D. 377, 610, 987



What are the next three numbers in this sequence?

2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233...

D. 377, 610, 987



The average of 3 numbers is 50. A 4th number is added to the list. The new average is now 100. What is the 4th number?

- A. 150
- B. 250
- C. 350
- D. 400



The average of 3 numbers is 50. A 4th number is added to the list. The new average is now 100. What is the 4th number?

B. 250

Let  $x = 4^{\text{th}}$  number

$3(50) = 150$  is the sum of the first three

$$(150 + x) \div 4 = 100$$

$$150 + x = 100(4)$$

$$150 + x = 400$$

$$x = 250$$





Javi was bragging to his brother about how fast he can ride his bike. Javi leaves an hour later than his brother. If Javi travels at 12 mph while his brother travels at 8 mph, how long will it take Javi to catch up to his brother?

- A. 1 hour
- B. 2 hours
- C. 3 hours
- D. 4 hours



Javi was bragging to his brother about how fast he can ride his bike. Javi leaves an hour later than his brother. If Javi travels at 12 mph while his brother travels at 8 mph, how long will it take Javi to catch up to his brother?



C. 3 hours

Distance at start time	1 hour later	2 hours later	3 hours later
0 for Javi	0	12	24
0 for brother	8	16	24

A dog and a cat together sell for the same price as 12 hamsters. Five cats sell for the price of one dog. How many hamsters would it take to equal the price of one dog?

- A. 10 hamsters
- B. 8 hamsters
- C. 6 hamsters
- D. 12 hamsters



A dog and a cat together sell for the same price as 12 hamsters. Five cats sell for the price of one dog. How many hamsters would it take to equal the price of one dog?

Let  $d$  = price of a dog  
Let  $c$  = price of cat  
Let  $h$  = price of hamster

$$d + c = 12h$$

$$d = 5c$$

$$5c + c = 12h$$

$$6c = 12h$$

$$c = 2h$$

$$d + c = 12h$$

$$d + 2h = 12h$$

$$d = 10h$$

A. 10



Four consecutive odd numbers add up to 296.  
What is the second smallest number?

- A. 65
- B. 71
- C. 73
- D. 67





Four consecutive odd numbers add up to 296.  
What is the second smallest number?

C. 73

Odd consecutive numbers are numbers like 3, 5, 7, and 9.

If the first is  $x$ , the second is  $x + 2$ .

The other two are  $x + 4$  and  $x + 6$ .

$$x + (x+2) + (x+4) + (x+6) = 296$$

$$4x + 12 = 296$$

$$4x = 284$$

$$x = 71$$

$$x+2 = 73 \text{ second smallest}$$

$$x+4 = 75$$

$$x+6 = 77$$

Sum is 296 so it checks.



End  
Round  
Four

Begin  
Alternate  
Round



What are the missing terms in this sequence?

8, \_\_, 24, 32, \_\_, \_\_,

- A. 16, 38, 42
- B. 16, 64, 128
- C. 12, 40, 52
- D. 16, 40, 48



# What are the missing terms in this sequence?

8, \_\_\_\_, 24, 32, \_\_\_\_, \_\_\_\_,

D. 16, 40, 48

This is a list of multiples of 8

$$8 \times 1 = 8$$

$$8 \times 2 = 16$$

$$8 \times 3 = 24$$

$$8 \times 4 = 32$$

$$8 \times 5 = 40$$

$$8 \times 6 = 48$$



List the cubes of the numbers from 1-5.

- A. 1, 8, 27, 64, 125
- B. 8, 27, 64, 125, 216
- C. 3, 6, 9, 12, 15
- D. 1, 3, 6, 9, 12



List the cubes of the numbers from 1-5.

A. 1, 8, 27, 64, 125

$$1 \times 1 \times 1 = 1$$

$$2 \times 2 \times 2 = 8$$

$$3 \times 3 \times 3 = 27$$

$$4 \times 4 \times 4 = 64$$

$$5 \times 5 \times 5 = 125$$



If Kaylee reads 2.1 pages per minute, how many pages does she read in 2.75 hours?

- A. 173.25
- B. 346.5
- C. 693
- D. 519.75



If Kaylee reads 2.1 pages per minute, how many pages does she read in 2.75 hours?

B. 346.5

$$2.1 \text{ pages/minute} (60 \text{ minutes/hour}) (2.75 \text{ hours}) = 346.5 \text{ pages}$$



Nathan weighs only 50% of his dad's weight. If their total weight is 243 pounds, how much does Nathan weigh?

- A. 86 pounds
- B. 91 pounds
- C. 72 pounds
- D. 81 pounds



Nathan weighs only 50% of his dad's weight. If their total weight is 243 pounds, how much does Nathan weigh?

Let  $x$  = Nathan's weight  
 $2x$  = dad's weight

$$x + 2x = 243$$

$$3x = 243$$

$$x = 243/3$$

$$x = 81$$

D. 81 pounds





Find the 100<sup>th</sup> term in the following sequence:

2, 5, 8, 11 ....

- A. 133
- B. 233
- C. 299
- D. 199



Find the 100<sup>th</sup> term in the following sequence:

2, 5, 8, 11 ....

This is an arithmetic sequence.

$$A_n = d(n-1) + c \text{ where } n = 100, d = 3 \text{ and } c = 2$$

$$A_{100} = 3(100-1) + 2$$

$$A_{100} = 3(99) + 2$$

$$A_{100} = 297 + 2$$

$$A_{100} = 299$$

C. 299



2 Apples + 1 Cherry = Pear

3 Cherries – 2 Apples = Pear

How many cherries equal a pear?

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



2 Apples + 1 Cherry = Pear

3 Cherries – 2 Apples = Pear

How many cherries equal a pear?

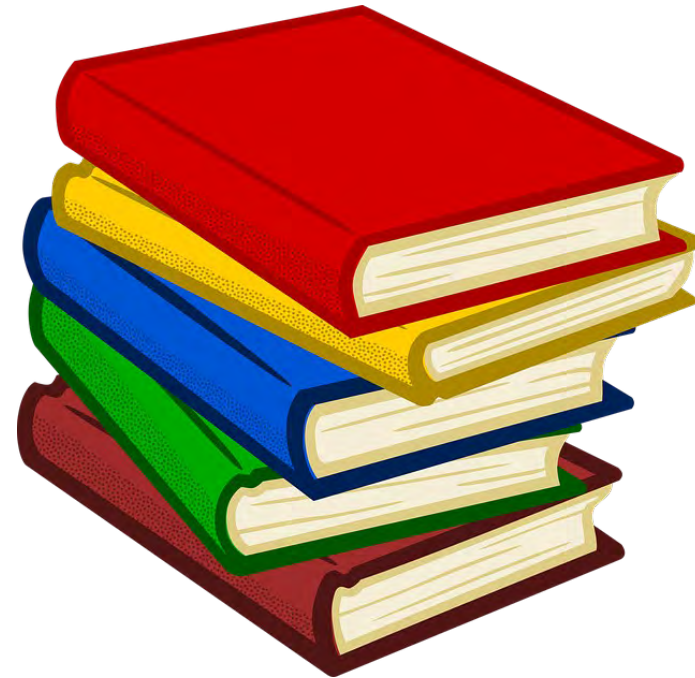
$$\begin{array}{rcl} 2 \text{ Apples} + 1 \text{ Cherry} & = & \text{Pear} \\ \hline - 2 \text{ Apples} + 3 \text{ Cherries} & = & \text{Pear} \\ \hline & 4 \text{ cherries} & = 2 \text{ pears} \\ & 2 \text{ cherries} & = 1 \text{ pear} \end{array}$$

D. 2



A math book plus two science books cost \$86. Five math books minus the price of two science books is \$64. What is the cost of one science book?

- A. \$25.50
- B. \$50.00
- C. \$25.00
- D. \$30.50





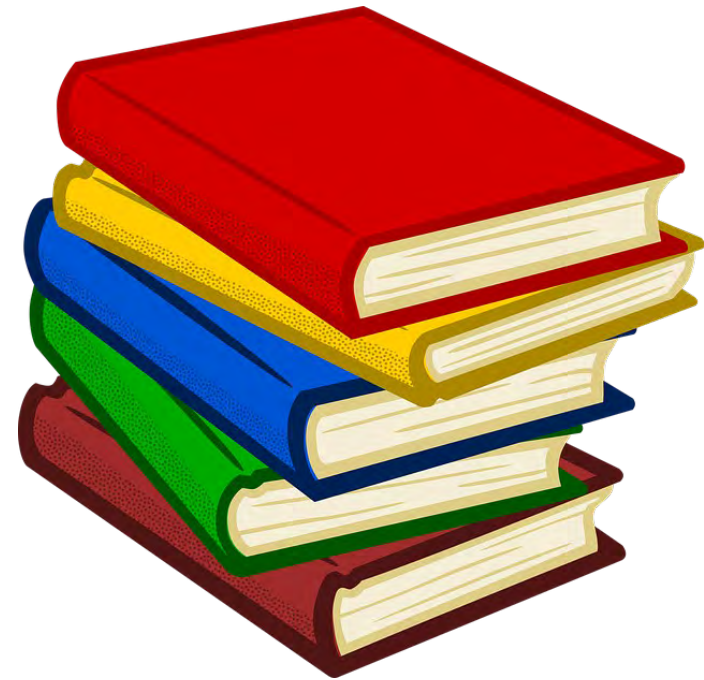
A math book plus two science books cost \$86. Five math books minus the price of two science books is \$64. What is the cost of one science book?

Let  $x$  = price of math book  
Let  $y$  = price of science book

$$x + 2y = 86$$
$$5x - 2y = 64$$

D. \$30.50

Add those equations together  
 $6x = 150$ , then divide by 6  
 $x = \$25$  is cost of math book  
Put this back into first equation  
 $25 + 2y = 86$   
Subtract 25 from both sides  
 $2y = 61$  and divide by 2  
 $y = \$30.50$



Michael has red, blue, white and brown socks in his sock drawer, and none are matched up. What is the least number of times he would need to draw out one sock at a time blindfolded to guarantee a match?

- A. 8
- B. 2
- C. 5
- D. 4



Michael has red, blue, white and brown socks in his sock drawer, and none are matched up. What is the least number of times he would need to draw out one sock at a time blindfolded to guarantee a match?

C. 5

In the worst case, every time he draws a sock, it is different from the ones drawn before. So if the first 4 are all different, the fifth sock drawn will have to match one of the first four.

