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# GRE Quantitative Reasoning Flash Cards

*Formulas, definitions, and concepts for success on the GRE Quantitative Reasoning Section*



## How to Study Flash Cards

All of the formulas from *The GRE Quantitative Reasoning Bible* are provided in the following flash cards. Review each card, and remove any formulas that you already know. Study only the cards with formulas that you have not yet memorized. To increase your retention of the formulas, try these study methods:

1. **Write out the formulas and their components.** Transferring the formulas to paper helps transfer the information into your long-term memory.
2. **Group formulas by content area.** By placing the cards in groups, such as "Circles" or "Transformations," you can begin to see connections between formulas that may help with memorization.

*(Continued on back of card)*



## Order of Operations

A fundamental principle of all math is the order of operations. This rule sets precedence for which operations are preformed first when solving or simplifying expressions and equations. The six operations are addition, subtraction, multiplication, division, exponentiation, and grouping, and their order of precedence is often remembered using the acronym PEMDAS.

Each of the letters in PEMDAS represents an operation and its order of priority:

| | | |
|---|---|---|
| **P** | arentheses (grouping) | *1st* |
| **E** | xponents | *2nd* |
| **M** | ultiply | *3rd* |
| **D** | ivide | *3rd* |
| **A** | dd | *4th* |
| **S** | ubtract | *4th* |

## How to Study Flash Cards

3. **Write sample questions that require each formula.** Write your own example questions, along with detailed solutions to your questions. The most effective strategy for learning information is to teach the information to someone else.
4. **Have someone quiz you.** Enlist a family member or friend to quiz you on each flash card. If you correctly identify or explain a formula, place a check mark in the target on the flash card. Once a formula is completely memorized, remove it from your stack of flash cards.



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## GRE QR Bible Flash Cards



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## Order of Operations

**P E M D A S**

Let's look at an example of an expression in which of the order of operations is required:

$$5(1 + 4)^2 - 10$$

Begin with operation in the parentheses (P):

$$5(1 + 4)^2 - 10 = 5(5)^2 - 10$$

Now remove the exponents (E):

$$5(5)^2 - 10 = 5(25) - 10$$

Multiplication and division are next (M/D):

$$5(25) - 10 = 125 - 10$$

Finally, addition and subtraction are performed (A/S):

$$125 - 10 = 115$$

## integer

Any number in the set of positive and negative whole numbers and zero:

{…–4, –3, –2, –1, 0, 1, 2, 3, 4…}

- Integers do not include fractions or decimals
- Integers are the most commonly used numbers on the GRE
- It is important to remember that 0 is an integer



## set

A collection of numbers marked by brackets:

{4, 6, 9, 13}

- Sets can contain any amount of numbers
- Sets may have rules, such as "all even integers"



## digit

The numbers 0 through 9:

{0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

- *Place* is used to represent where in a number a digit occurs
- The ones digit or units digit in 3748 is 8
- The tens digit in 3748 is 4
- The hundreds digit in 3748 is 7



## sum

The amount obtained by adding numbers

- The sum of 2, 3, and 4 is 9: $(2 + 3 + 4 = 9)$
- The sum of $x$ and $y$ is $x + y$



## product

The amount obtained by multiplying numbers

- The product of 2, 3, and 4 is 24: $(2 \times 3 \times 4 = 24)$
- The product of $x$ and $y$ is $xy$



## multiple

An integer that is divisible by another integer without a remainder

- Multiples of 3 include {–6, –3, 3, 6, 9, 12}
- Multiples of 4 include {–8, –4, 4, 8, 12, 16}

DEFINITION

# set



DEFINITION

# integer

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DEFINITION

# sum

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DEFINITION

# digit

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DEFINITION

# multiple

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DEFINITION

# product

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## divisible

Describes a number capable of being divided without a remainder. A number that is divisible by $x$ is also said to be a multiple of $x$.

- 18 is divisible by 1, 2, 3, 6, 9, and 18
- $xy$ is divisible by 1, $x$, $y$, and $xy$



## factor

One of two or more numbers that divides into a larger number without a remainder

- Factors of 18 are 1 and 18, 2 and 9, and 3 and 6
- Factors of $xy$ include 1 and $xy$, plus $x$ and $y$



## 10 prime numbers

{2, 3, 5, 7, 11, 13, 17, 19, 23, 29, ...}

Additional prime numbers under 100:

{31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97}



## prime number

An integer that does not have any factors besides itself and 1

{2, 3, 5, 7, 11, 13, 17, 19, 23, 29, ...}

- One (1) is not a prime number
- When prime numbers are multiplied together, the product's factors are limited to itself, one, and the prime numbers themselves



## prime factor

Prime numbers that divide into a larger number without a remainder

- Factors of 18 are 1 and 18, 2 and 9, and 3 and 6; the prime factors are 2 and 3



## common factor

A factor shared by two numbers

- Factors of 18 are 1 and 18, 2 and 9, and 3 and 6.
- Factors of 15 are 1 and 15 and 3 and 5.
- The common factors of 15 and 18 are 1 and 3.

DEFINITION

**factor**

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DEFINITION

**divisible**

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DEFINITION

**prime number**

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ARITHMETIC

What are the first
10 prime numbers?

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DEFINITION

**common factor**

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DEFINITION

**prime factor**

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## Rules of Divisibility

2: If the last digit of a number is even, it is a multiple of 2.
3: If the sum of the digits is divisible by 3, the entire integer is a multiple of 3.
4: If the last two digits are a multiple of 4, the entire number is a multiple of 4.
5: If the last digit ends in 0 or 5, the entire number is divisible by 5.
6: If the number is both divisible by 2 and 3, it is divisible by 6.
9: If the sum of the digits is divisible by 9, the entire integer is a multiple of 9



## Addition of Integers

even + even = even
odd + odd = even
odd + even = odd

positive + positive = positive
negative + negative = negative
positive + negative = can be either

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## Fraction Equivalent

0.125

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## Multiplication of Integers

even × even = even
odd × odd = odd
odd × even = even

positive × positive = positive
negative × negative = positive
positive × negative = negative

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## Fraction Equivalent

$0.16\overline{6}$

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## Fraction Equivalent

0.2

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## ARITHMETIC

# Addition of Integers

even + even =
odd + odd =
odd + even =

positive + positive =
negative + negative =
positive + negative =



## SHORTCUT

# Rules of Divisibility



## ARITHMETIC

# Multiplication of Integers

even + even =
odd + odd =
odd + even =

positive + positive =
negative + negative =
positive + negative =



## DECIMAL EQUIVALENT

$$\frac{1}{8}$$



## DECIMAL EQUIVALENT

$$\frac{1}{5}$$



## DECIMAL EQUIVALENT

$$\frac{1}{6}$$

## Fraction Equivalent

$0.25$



## Fraction Equivalent

$0.3\overline{3}$

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## Fraction Equivalent

$0.5$

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## Fraction Equivalent

$0.4$

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## Fraction Equivalent

$0.6\overline{6}$

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## Fraction Equivalent

$0.75$

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## DECIMAL EQUIVALENT

$$\frac{1}{3}$$

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## DECIMAL EQUIVALENT

$$\frac{1}{4}$$

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## DECIMAL EQUIVALENT

$$\frac{2}{5}$$

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## DECIMAL EQUIVALENT

$$\frac{1}{2}$$

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## DECIMAL EQUIVALENT

$$\frac{3}{4}$$

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## DECIMAL EQUIVALENT

$$\frac{2}{3}$$

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## rate formula

$$r = \frac{d}{t}$$

r = rate  d = distance  t = time



## what percent?

$$\frac{x}{100} \text{ or } \frac{?}{100}$$



## average rate of speed

$$\frac{2 \times \text{rate}_1 \times \text{rate}_2}{\text{rate}_1 + \text{rate}_2}$$



## combined work

$$\frac{1}{t_1} + \frac{1}{t_2} + \frac{1}{t_3} = \frac{1}{t_T}$$

$t_1$ = time of first person
$t_2$ = time of second person
$t_3$ = time of third person
$t_T$ = time together



## plus, more than, added to, increased by, sum

$$+$$



## what? what number?

x, n, ?, or
other variable

## TRANSLATE

How do you represent the phrase "what percent"?

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## WORK AND RATES

What is the rate formula?

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## WORK AND RATES

What is the formula for combined work problems?

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## WORK AND RATES

What is the formula for average rate of speed?

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## TRANSLATE

How do you represent "what" or "what number?"

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## TRANSLATE

How do you represent "plus," "more than," "added to," "increased by," and "sum?"

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## minus, less than, subtracted from, decreased by, reduced by, difference

$-$

(minus sign)



## of, times, product

$\times$

(multiplication sign)

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## per, out of, quotient

$\div$

(division sign)

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## is, equals, result

$=$

(equals sign)

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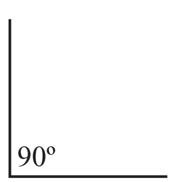
## 90º angle

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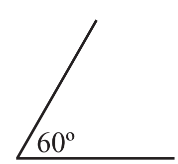
## 60º angle

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TRANSLATE

How do you represent "of," "times," or "product?"



TRANSLATE

How do you represent "minus," "less than," "subtracted from," "decreased by," "reduced by," and "difference?"

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TRANSLATE

How do you represent "is," "equals," or "result?"

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TRANSLATE

How do you represent "per," "out of," or "quotient?"

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BENCHMARKS

Illustrate a 60º angle.

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BENCHMARKS

Illustrate a 90º angle.

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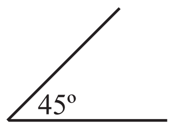
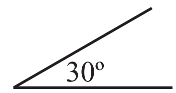
## 45º angle






## 30º angle






## divide by same base

$$x^n \div x^m = x^{n-m}$$



## multiply by same base

$$(x^n)(x^m) = x^{n+m}$$



## multiply by same power

$$(x^n)(y^n) = (xy)^n$$



## divide by same power

$$x^n \div y^n = (x \div y)^n$$

BENCHMARKS

Illustrate a 30º angle.

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BENCHMARKS

Illustrate a 45º angle.

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EXPONENTS AND ROOTS

Multiplication of the same base:

$(x^n)(x^m)$

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EXPONENTS AND ROOTS

Division of the same base:

$x^n \div x^m$

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EXPONENTS AND ROOTS

Division with the same power:

$x^n \div y^n$

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EXPONENTS AND ROOTS

Multiplication with the same power:

$(x^n)(y^n)$

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## base$^{-\text{negative}}$

$$\frac{1}{x^n}$$



## base$^0$

$$1$$

$3^0 = 1$ and $x^0 = 1$



## single base with powers

$$(x^n)^m = x^{n \times m}$$



## fractional exponents

$$x^{\frac{n}{m}} = \sqrt[m]{x^n}$$

$$x^{\frac{\text{power}}{\text{root}}} = \sqrt[\text{root}]{x^{\text{power}}}$$



## classic form #2

$$(x + y)^2 = x^2 + 2xy + y^2$$

Examples:

$(t + 5)^2 \rightarrow t^2 + 2(t)(5) + 5^2 \rightarrow t^2 + 10t + 25$

$(3a + b)(3a + b) \rightarrow 9a^2 + 6ab + b^2$

$y^2 + 16y + 64 \rightarrow y^2 + 2(y)(8) + 8^2 \rightarrow (y + 8)^2$

$36 + 12n + n^2 \rightarrow 6^2 + 2(n)(6) + n^2 \rightarrow (6 + n)^2$



## classic form #1

$$(x + y)(x - y) = x^2 - y^2$$

Examples:

$(t - 5)(t + 5) \rightarrow t^2 - 5^2 \rightarrow t^2 - 25$

$(3a + b)(3a - b) \rightarrow (3a)^2 - b^2 \rightarrow 9a^2 - b^2$

$y^2 - 64 \rightarrow y^2 - 8^2 \rightarrow (y + 8)(y - 8)$

$36 - n^2 \rightarrow 36^2 - n^2 \rightarrow (6 + n)(6 - n)$

## EXPONENTS AND ROOTS

When a base is raised to the power of 0, what is the result?

For example, what is $3^0$ or $x^0$?



## EXPONENTS AND ROOTS

$$x^{-n}$$

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## EXPONENTS AND ROOTS

Fractional exponents:

$$x^{\frac{n}{m}}$$

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## EXPONENTS AND ROOTS

Multiplication of a single base with multiple powers:

$$(x^n)^m$$

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## CLASSIC QUADRATIC FORM

$$(x + y)(x - y) =$$

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## CLASSIC QUADRATIC FORM

$$(x + y)^2 =$$

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## classic form #3

$$(x - y)^2 = x^2 - 2xy + y^2$$

Examples:

$(t - 5)^2 \quad \rightarrow \quad t^2 - 2(t)(5) + 5^2 \quad \rightarrow \quad t^2 - 10t + 25$

$(3a - b)(3a - b) \quad \rightarrow \quad 9a^2 - 6ab + b^2$

$y^2 - 16y + 64 \quad \rightarrow \quad y^2 - 2(y)(8) + 8^2 \quad \rightarrow \quad (y - 8)^2$

$36 - 12n + n^2 \quad \rightarrow \quad 6^2 - 2(n)(6) + n^2 \quad \rightarrow \quad (6 - n)^2$



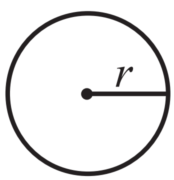
## direct variation

$$y = cx$$



## area of a circle

$$A = \pi r^2$$





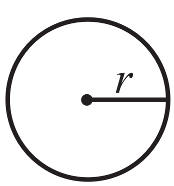

## indirect variation

$$c = xy$$



## circumference of a circle

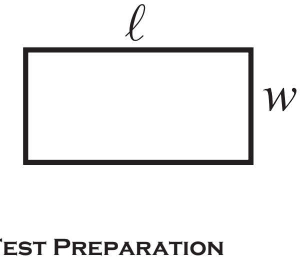
$$C = 2\pi r$$






## area of a rectangle

$$A = \ell w$$



DIRECT VARIATION

What is the formula for direct variation?

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CLASSIC QUADRATIC FORM

$$(x - y)^2 =$$

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INDIRECT VARIATION

What is the formula for indirect variation?

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GEOMETRY

What is the formula for the area of a circle?

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GEOMETRY

What is the formula for the area of a rectangle?

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GEOMETRY

What is the formula for the circumference of a circle?

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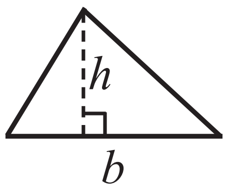
## area of a triangle

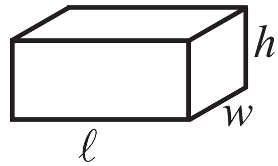
$$A = \frac{1}{2}bh$$






## volume of a rectangular solid

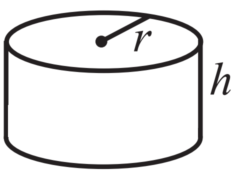
$$V = \ell wh$$






## volume of a cylinder

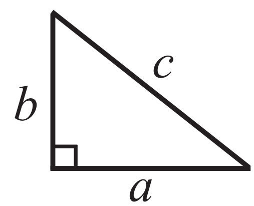
$$V = \pi r^2 h$$





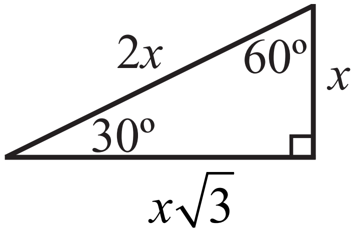

## Pythagorean Theorem

$$a^2 + b^2 = c^2$$



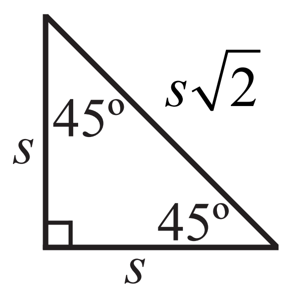



## 30º:60º:90º triangle






## 45º:45º:90º triangle



## GEOMETRY

What is the formula for the volume of a rectangular solid?



## GEOMETRY

What is the formula for the area of a triangle?

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## GEOMETRY

What is the Pythagorean Theorem?

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## GEOMETRY

What is the formula for the volume of a right circular cylinder?

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## GEOMETRY

What are the assigned side ratios in a $45^\circ:45^\circ:90^\circ$ triangle?

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## GEOMETRY

What are the assigned side ratios in a $30^\circ:60^\circ:90^\circ$ triangle?

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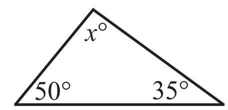
## degrees of arc in a circle

$360^\circ$



## sum of the angles in a triangle

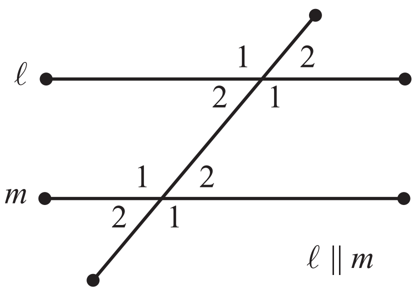
$180^\circ$




$x^\circ + 50^\circ + 35^\circ = 180^\circ \qquad x = 95^\circ$



## intersected parallel lines

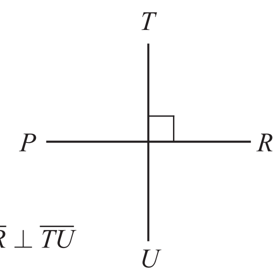



$\ell \parallel m$



## perpendicular lines

right angle

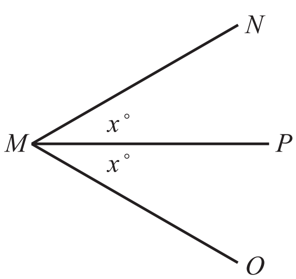



$\overline{PR} \perp \overline{TU}$



## bisect

bisect = to divide in two equal parts






## perimeter of a triangle

$$\text{perimeter} = s_1 + s_2 + s_3$$

## GEOMETRY

What is the sum of of the measures in degrees of the angles of a triangle?



## GEOMETRY

How many degrees of arc are in a circle?

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## GEOMETRY

What angle is created by the intersection of perpendicular lines?

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## GEOMETRY

What relationship results when two or more parallel lines are intersected by a transversal?

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## GEOMETRY

What is the formula for finding the perimeter of a triangle?

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## GEOMETRY

What is the definition of "bisect?"

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## sum of the lengths of 2 sides

The sum of the lengths of any two sides of a triangle is always greater than the length of the remaining side.



## sum of the angles in a triangle

180º



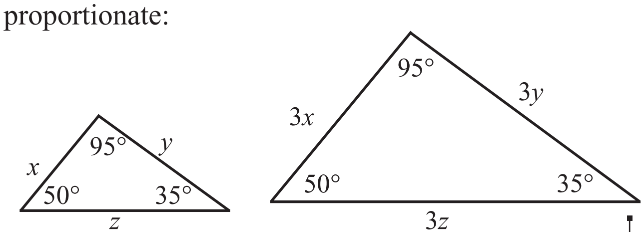
## Pythagorean Triples

3 : 4 : 5
5 : 12 : 13
7 : 24 : 25
8 : 15 : 17
9 : 40 : 41
12 : 35 : 37
20 : 21 : 29



## similar triangles

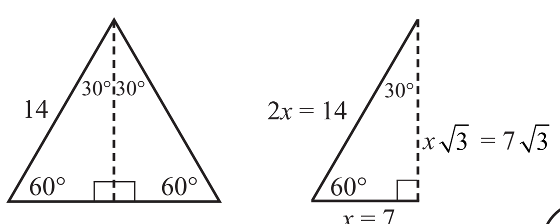
Triangles that have the exact same shape but different area. The corresponding angle measurements of similar triangles are equal, and the corresponding side lengths are proportionate:






## hidden triangles

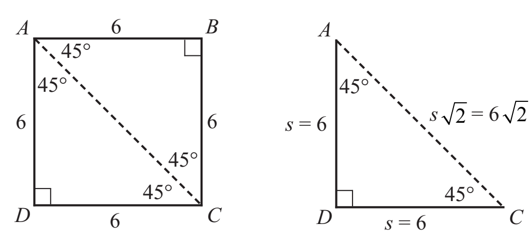
Two 30º:60º:90º triangles are hidden in every equilateral triangle:






## hidden triangles

Two 45º:45º:90º triangles are hidden in every square:



## GEOMETRY

What is the sum of of the measures in degrees of the angles of a triangle?



## GEOMETRY

The sum of the lengths of any two sides of a triangle is always greater than ____________________.

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## GEOMETRY

What are similar triangles?

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## GEOMETRY

Name the most common Pythagorean Triples.

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## GEOMETRY

What is hidden in a square?

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## GEOMETRY

What is hidden in an equilateral triangle?

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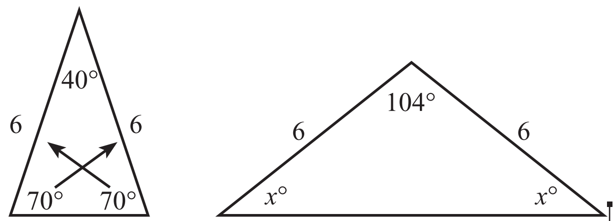
## isosceles triangles

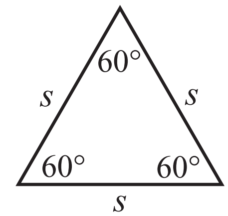
An isosceles triangle has two sides of equal length and two angles of equal size. The two equal angles are opposite the two equal-length sides:






## equilateral triangles

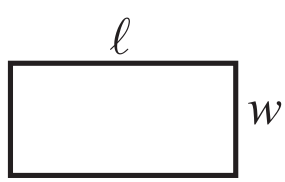
Equilateral triangles have equal side lengths and equal angle measurements. Since the interior angles of a triangle add up to 180˚, the three angles of an equilateral triangle must each equal 60°:






## perimeter of a rectangle

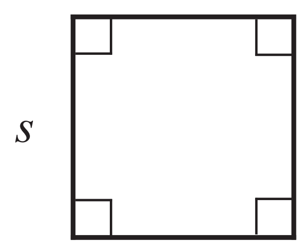
$$P = 2\ell + 2w$$






## area of a square

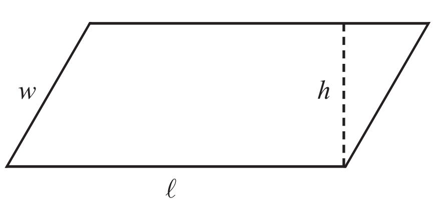
$$A = \ell w \text{ or } s^2$$






## area of a parallelogram

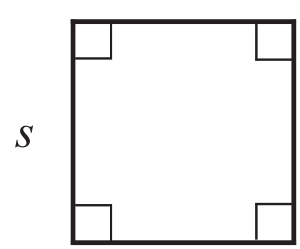
$$A = \ell h$$






## perimeter of a square

$$P = 4s$$



GEOMETRY

What is an equilateral triangle?



GEOMETRY

What is an isosceles triangle?

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GEOMETRY

What is the formula for the area of a square?

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GEOMETRY

What is the formula for the perimeter of a rectangle?

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GEOMETRY

What is the formula for the perimeter of a square?

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GEOMETRY

What is the formula for the area of a parallelogram?

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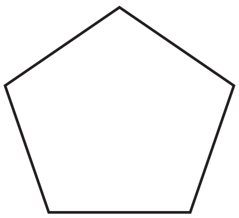
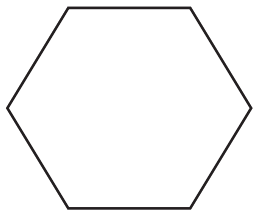
## regular polygons

Polygons that have equal side lengths and equal angle measurements are called regular polygons.



Regular Pentagon

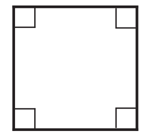


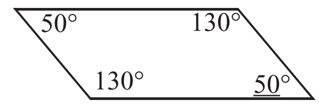
Regular Hexagon



## interior angles of a quadrilateral

# 360º





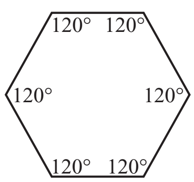

90º+90º+90º+90º=360º

50º+130º+50º+130º=360º



## interior angles of a hexagon

# 720º

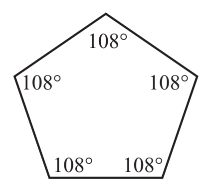



120º + 120º + 120º + 120º + 120º + 120º = 720º



## interior angles of a pentagon

# 540º

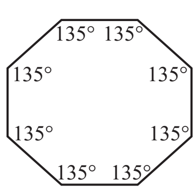



108º + 108º + 108º + 108º + 108º = 540º



## interior angles of a octagon

# 1080º

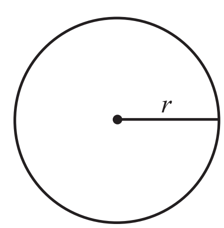



135º+135º+135º+135º+135º+135º+135º+135º = 1080º



## circumference of a circle

$$C = 2\pi r$$



## GEOMETRY

What is the sum of the interior angles of a quadrilateral?

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## GEOMETRY

What is a regular polygon?

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## GEOMETRY

What is the sum of the interior angles of a pentagon? What is the measure of each angle in a regular pentagon?

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## GEOMETRY

What is the sum of the interior angles of a hexagon? What is the measure of each angle in a regular hexagon?

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## GEOMETRY

What is the formula for the circumference of a circle?

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## GEOMETRY

What is the sum of the interior angles of a octagon? What is the measure of each angle in a regular octagon?

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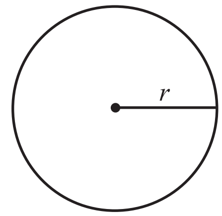
## tangent

A tangent is a line that touches a circle at only one point. A radius or diameter drawn to that point is perpendicular to the tangent.



## area of a circle

$$A = \pi r^2$$






## length of an arc

$$\text{The length of an arc} = \frac{x^\circ}{360^\circ}(2\pi r)$$



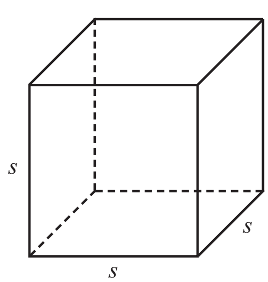
## area of a sector

$$\text{The area of a sector} = \frac{x^\circ}{360^\circ}(\pi r^2)$$



## volume of a cube

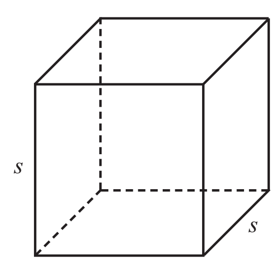
$$V = s^3$$






## surface area of a cube

$$SA = 6s^2$$



GEOMETRY

What is the formula for the area of a circle?



GEOMETRY

What is a tangent?



GEOMETRY

What is the formula for finding the area of a sector?



GEOMETRY

What is the formula for finding the length of an arc?



GEOMETRY

What is the formula for the surface area of a cube?

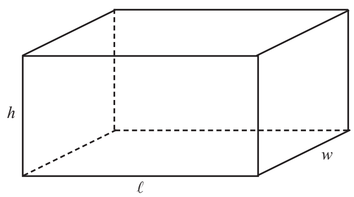


GEOMETRY

What is the formula for the volume of a cube?

## volume of a rectangular solid

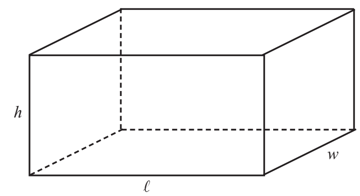
$$V = \ell w h$$






## surface area of a rectangular solid

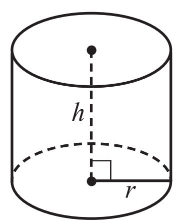
$$SA = 2\ell w + 2\ell h + 2wh$$






## volume of a cylinder

$$V = \pi r^2 h$$






## length of a diagonal in a rectangular solid

Length of the diagonal =

$$\sqrt{l^2 + w^2 + h^2}$$



## distance formula

$$\text{Distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



## midpoint formula

$$\text{Midpoint} = \left(\frac{x_1 + x_2}{2}, \ \frac{y_1 + y_2}{2}\right)$$

## GEOMETRY

What is the formula for the surface area of a rectangular solid?

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## GEOMETRY

What is the formula for the volume of a rectangular solid?

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## GEOMETRY

What is the formula for the length of a diagonal in a rectangular solid?

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## GEOMETRY

What is the formula for the volume of a right circular cylinder?

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## COORDINATE GEOMETRY

What is the Midpoint Formula?

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## COORDINATE GEOMETRY

What is the Distance Formula?

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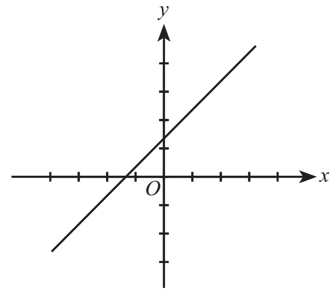
## slope formula

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$



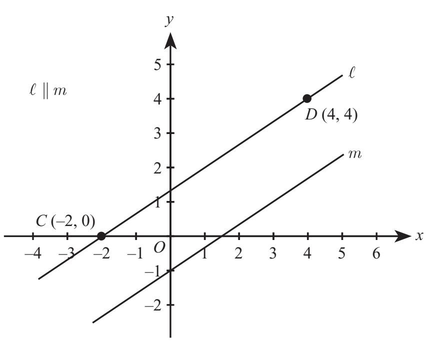
## up




Positive Slope



## parallel lines have equal slopes

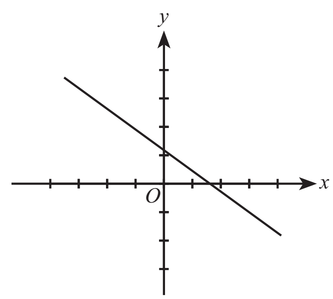



Slope of line $\ell = \frac{2}{3}$

Slope of line $m = \frac{2}{3}$



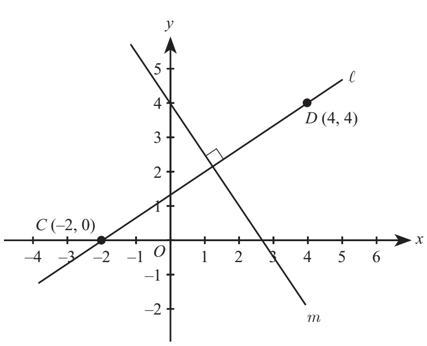
## down




Negative Slope



## perpendicular lines have slopes that are negative reciprocals




Slope of line $\ell = \frac{2}{3}$

Slope of line $m = -\frac{3}{2}$



## equation of a line

Equation of a line: $y = mx + b$

Where:

$m$ = slope
$b$ = $y$-intercept
$x$ and $y$ = the $x$- and $y$-coordinate
($x$, $y$) of any point on the line

COORDINATE GEOMETRY

Lines with a positive slope tilt _______ when moving from left to right.

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COORDINATE GEOMETRY

What is the Slope Formula?

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COORDINATE GEOMETRY

Lines with a negative slope tilt _______ when moving from left to right.

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COORDINATE GEOMETRY

How are the slopes of parallel lines related?

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COORDINATE GEOMETRY

What is the equation of a line?

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COORDINATE GEOMETRY

How are the slopes of perpendicular lines related?

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## standard equation of a parabola

Standard equation of a parabola: $y = ax^2 + bx + c$

- $a$, $b$, and $c$ are constants
- $x$ and $y$ = the $x$- and $y$-coordinate $(x, y)$ of any point on the parabola
- $(0, c)$ is the $y$-intercept

- When $a$ is positive, the parabola opens upward
- When $a$ is negative, the parabola opens downward
- When $b = 0$, the parabola is centered on the $y$-axis
- When $b > 0$, the parabola moves to the left of the $y$-axis
- When $b < 0$, the parabola moves to the right of the $y$-axis



## vertex equation of a parabola

Vertex equation of a parabola: $y = a(x - h)^2 + k$

- $(h, k)$ is the vertex of the parabola
- $x$ and $y$ = the $x$- and $y$-coordinate $(x, y)$ of any point on the parabola

- When $a$ is positive, the parabola opens upward
- When $a$ is negative, the parabola opens downward



## equation of a linear function

Equation of a line: $y = mx + b$
Equation of a linear function: $f(x) = mx + b$

Where:
$m$ = slope
$b$ = $y$-intercept
$x$ and $f(x)$ = the $x$- and $y$-coordinate $(x, y)$ of any point on the line



## standard equation of a quadratic function

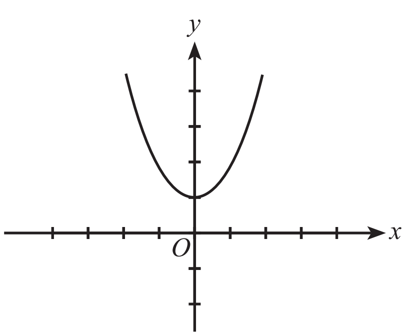
Standard equation of a parabola:
$$y = ax^2 + bx + c$$

Standard equation of a quadratic function:
$$f(x) = ax^2 + bx + c$$



## y = f(x) + 1

Shifts up 1 unit






## vertex equation of a quadratic function

Vertex equation of a parabola:
$$y = a(x - h)^2 + k$$

Vertex equation of a quadratic function:
$$f(x) = a(x - h)^2 + k$$

## COORDINATE GEOMETRY

Lines with a positive slope tilt ______ when moving from left to right.



## COORDINATE GEOMETRY

What is the standard equation of a parabola?

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## COORDINATE GEOMETRY

What is the standard equation of a quadratic function?

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## COORDINATE GEOMETRY

What is the equation of a linear function?

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## COORDINATE GEOMETRY

What is the vertex equation of a quadratic function?

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## COORDINATE GEOMETRY

Translation:

$$y = f(x) + 1$$

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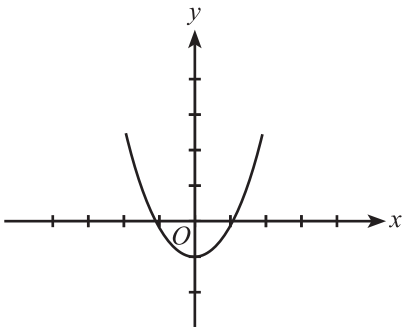
## $y = f(x) - 1$

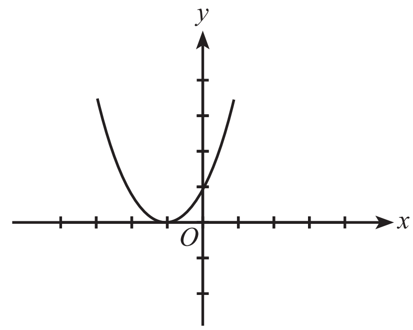
Shifts down 1 unit






## $y = f(x + 1)$

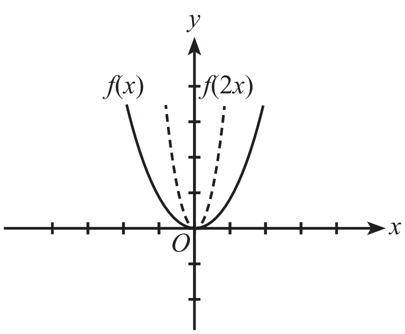
Shifts left 1 unit






## $y = f(2x)$

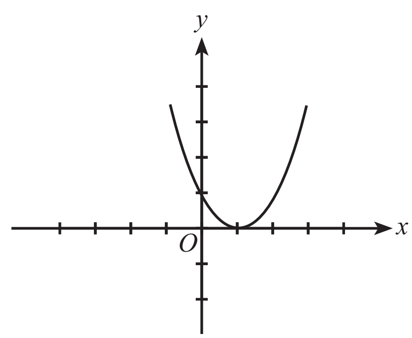
The parabola becomes "skinnier"






## $y = f(x - 1)$

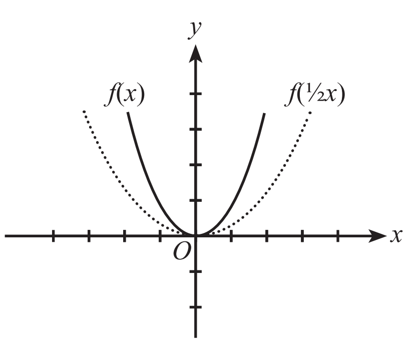
Shifts right 1 unit






## $y = f(\frac{1}{2}x)$

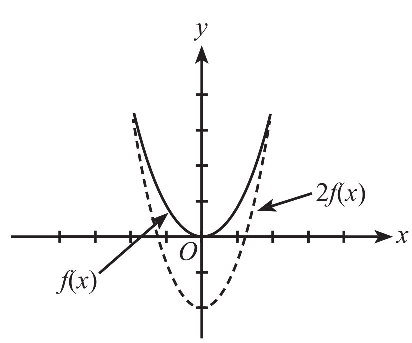
The parabola becomes "fatter"






## $y = 2f(x)$

The parabola becomes "longer"



COORDINATE GEOMETRY

# Translation:

$y = f(x + 1)$

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COORDINATE GEOMETRY

# Translation:

$y = f(x) - 1$

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COORDINATE GEOMETRY

# Translation:

$y = f(x - 1)$

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COORDINATE GEOMETRY

# Transformation:

$y = f(2x)$

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COORDINATE GEOMETRY

# Transformation:

$y = 2f(x)$

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COORDINATE GEOMETRY

# Transformation:

$y = f(\frac{1}{2}x)$

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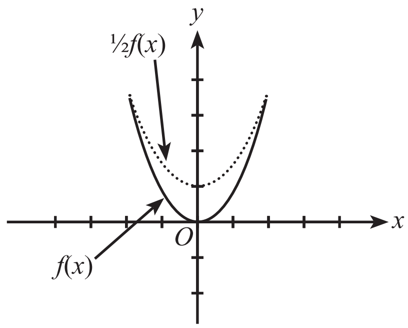
## y = ½f(x)

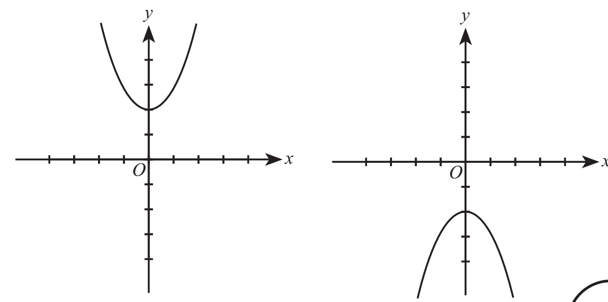
The parabola becomes "shorter"






## reflection over the x-axis

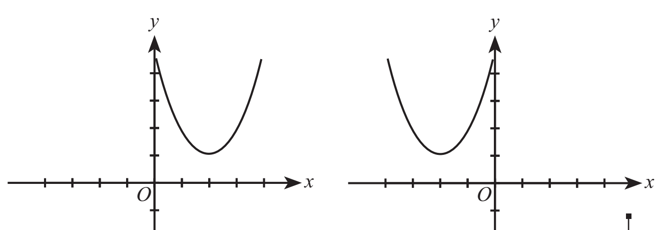
$y = f(x)$ $y = -f(x)$






## reflection over the y-axis

$y = f(x)$ $y = f(-x)$






## average (arithmetic mean)

$$\frac{\text{sum of the numbers}}{\text{number of numbers}} = \text{average}$$



## median

The median is the number that appears in the middle of a set of ascending numbers.

In the following set, the median is 5:
{2, 4, 5, 7, 7}



## mode

The mode is the number that appears most frequently in a set.

In the following set, the mode is 7:
{2, 4, 5, 7, 7}

## COORDINATE GEOMETRY

Reflection:

$y = -f(x)$



## COORDINATE GEOMETRY

Transformation:

$y = \frac{1}{2} f(x)$

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## STATISTICS

What is the formula for finding the average of a set of numbers?

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## COORDINATE GEOMETRY

Reflection:

$y = f(-x)$

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## STATISTICS

What is the mode?

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## STATISTICS

What is the median?

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## probability formula

Probability =

$$\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$



## probability of a non-occurrence

Probability of event not occurring =

$$1-\frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$



## geometric sequence

In a geometric sequence, each term increases by a constant ratio.

$a_n = a_1 \times r^{n-1}$

Where:
$a_1$ = the first term
$n$ = the number of terms
$r$ = constant ratio



## arithmetic sequence

In an arithmetic sequence, each term increases by a constant difference.

$a_n = a_1 + (n-1)d$

Where:
$a_1$ = the first term
$n$ = the number of terms
$d$ = constant difference



## geometric sequence sum

Sum of the first $n$ terms in a geometric sequence =

$$\frac{a_1(1-r^n)}{1-r}$$



## arithmetic sequence sum

Sum of the first $n$ terms in an arithmetic sequence =

$$n\frac{a_1+a_n}{2}$$

PROBABILITY

What is the formula for the probability of something not happening?



PROBABILITY

What is the formula for probability?

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SEQUENCES

What is an arithmetic sequence and how do you find the *n*th term?

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SEQUENCES

What is a geometric sequence and how do you find the *n*th term?

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SEQUENCES

How do you find the sum of the first $n$ terms in an arithmetic sequence?

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SEQUENCES

How do you find the sum of the first $n$ terms in a geometric sequence?

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## geometric probability

Geometric Probability =

$$\frac{\text{shaded area}}{\text{total possible area}}$$



## overlapping groups

Group A
\+ Group B
\+ Neither Group
<u>– Both Groups</u>
Total



## probability of two events

Find the probability of each independent event and then find their product.



## combinations

Multiply the elements together:

2 shirts × 3 pants × 2 shoes = 12 outfit combinations



## standard deviation

The measure of how near or far, on average, each number in the set tends to be from the set's overall average.



## permutations

Determine the number of elements for each position and then multiply the elements together:

| First Place | | Second Place | | Third Place | | Fourth Place | |
|---|---|---|---|---|---|---|---|
| 4 | × | 3 | × | 2 | × | 1 | = 24 |
| <u>A</u>, B, C, D | | <u>B</u>, C, D | | <u>C</u>, D | | <u>D</u> | |

## OVERLAPPING GROUPS

What is the formula for finding a population in an overlapping groups question?



## PROBABILITY

What is the formula for geometric probability?

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## COUNTING PROBLEMS

In a combination, how do you find the total number of arrangements?

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## PROBABILITY

How do you find the probability of two independent events both occurring?

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## COUNTING PROBLEMS

In a permutation, how do you find the total number of arrangements?

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## STATISTICS

What is the standard deviation of a set of numbers?

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## percent change

$$\frac{\text{amount of change}}{\text{original amount}} \times 100\% = \text{percent change}$$



## percent change

For percent increase questions, the multiplier is 1 + the percent (expressed as a decimal):

| Percent Change | Multiplier |
|---|---|
| Increase by 5% | 1.05 |
| Increase by 30% | 1.30 |
| Increase by 65% | 1.65 |
| Increase by 80% | 1.8 |



## normal distribution

A normal distribution graph groups the values in a data set in a predictable way. Called the 68–95–99 rule, normal distribution indicates that 68% of all values will fall within 1 standard deviation, 95% within 2 standard deviations, and 99.7% within 3 standard deviations.



## percent change

For percent decrease questions, the multiplier is 1 – the percent (expressed as a decimal):

| Percent Change | Multiplier |
|---|---|
| Decrease by 5% | 0.95 |
| Decrease by 30% | 0.7 |
| Decrease by 65% | 0.35 |
| Decrease by 80% | 0.2 |



## changing the range

1. The smallest or largest number of the set is removed.

2. A number that is greater than the largest number or less than the smallest number is added to teh set.



## range

The range of a set of numbers is simply the difference between the greatest number in the set and the least number in the set.

{2, 4, 5, 7, 9, 11, 12, 14}

14 – 2 = 12 The range is 12.

ARITHEMTIC

What is the multiplier for percent *increase* questions?



ARITHMETIC

What is the formula for percent change?

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ARITHEMTIC

What is the multiplier for percent *decrease* questions?

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STATISTICS

What is a normal distribution?

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STATISTICS

What is the range of a set of numbers?

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STATISTICS

In what two ways can you affect the range of a set of numbers?

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