ACT Math Test *COORDINATE GEOMETRY FORMULAS & TIPS*

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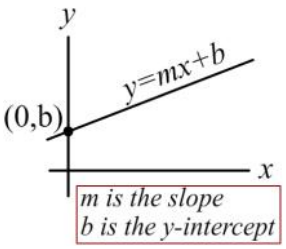
Expect NINE Coordinate Geometry problems on your ACT Math Test.
***Disclaimers**: Keep in mind that **this page does not cover every coordinate geometry concept** you may need on the ACT Math Test. Also, this page **may contain errors**. If you find an error, we'd love to hear about it: mathontime@gmail.com*

SLOPE of a LINE



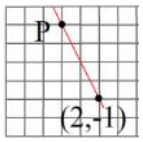
Slope-intercept form of a line: $y = mx + b$

Ex. Find the equation of a line with slope 7 that contains point (2,1). Use $m = 7$ in the equation above to get $y = 7x+b$. To find b, plug in the point (2,1) to get $1 = 7 \cdot 2 + b$ or $b = -13$. Thus $y = 7x-13$.

Ex. Put $6x + 3y = 1$ in slope-intercept form. Subtract $6x$ from both sides to get $3y = -6x+1$. Next, divide both sides by 3 to get the slope-intercept form $y = -2x+1/3$.

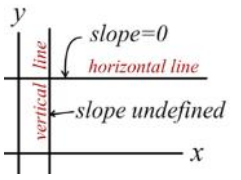
Slope of line containing (x_1, y_1) and (x_2, y_2): $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Ex. A line through points (-1,4) and (2,5) has slope $m = \dfrac{5-4}{2-(-1)} = \dfrac{1}{3}$



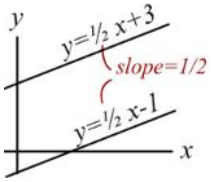
GRID Representation

Ex: Point (2,–1) is 4 units BELOW point P and 2 units to the RIGHT of P, so the slope of a line through these two points is m = rise/run = – 4/2 = – 2.



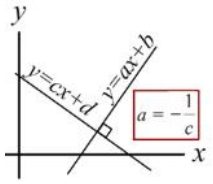
The slope of a horizontal line is 0. The slope of a vertical line is undefined.

Ex. y=5 is a horizontal line (zero slope), x= –3 is a vertical line (undefined slope).



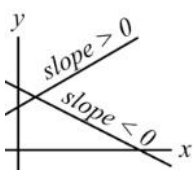
Parallel lines have the SAME slope.

Ex. The lines y= –10x–4 and y= –10x+200 are parallel since both have a slope equal to –10.



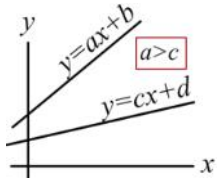
Perpendicular lines have slopes that are negative reciprocals.

Ex. y=2x–12 is perpendicular to y= –0.5x+3 since the neg. reciprocal of 2 is –1/2 = – 0.5.



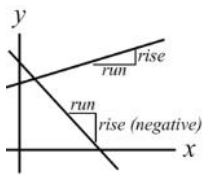
A line with positive slope goes up and to the right as x increases. A line with negative slope goes down as x increases.

Ex. y= –x+1 has slope –1 and goes down as x increases.



For two lines with positive slopes, the steeper line has larger slope (shown above).

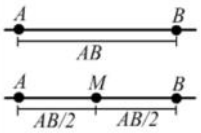
For two lines with negative slopes, the steeper line has a more negative slope.



SLOPE = Rise/Run
As *x* increases (run is positive), the rise will be either positive (for positive slope) or negative (for negative slope).

LINE SEGMENTS & MIDPOINT

- A line segment is defined by two points, A & B, on a line.
- A line segment has a specific length, *AB*.
- The MIDPOINT, *M*, of a line segment divides it in half.
- The midpoint between two points on the real number line is $(x_1 + x_2)/2$
- The midpoint between two points in the x-y plane is the point $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$



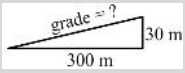
Ex. On the real number line, the midpoint between –3 and 12 is (12+(–3))/2 = 4.5

Ex. Find the point of INTERSECTION of the two LINES $x-2y = 4$ and $2x-3y = 9$. Steps:
(1) Solve for x in first equation: $x = 4+2y$
(2) Plug this x into second equation: $2(4+2y)-3y = 9$
(3) Solve for y: $8+4y-3y=9$ or $y = 1$
(4) Plug $y=1$ back into 1st eq: $x - 2 \cdot 1 = 4$, so $x = 6$.
Answer (6,1) *is the point where the lines intersect.*

The GRADE of a path or road is

$$\text{Grade} = \frac{\text{rise}}{\text{run}} \cdot 100\%$$

Ex. Find the grade of a path that rises 30 m for every 300 m.



$$\frac{30}{300}(100\%) = 10\%$$

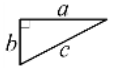
LENGTH & DISTANCE

The distance between points (x_1, y_1) and (x_2, y_2) is

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

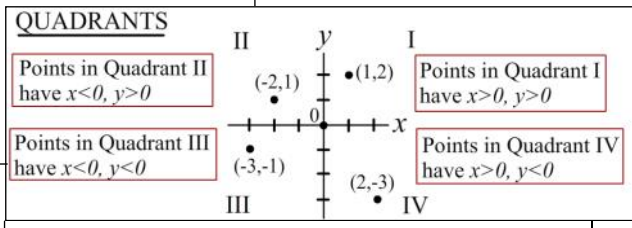
This is also the length of the line segment with these two endpoints.

Another way to find length is to spot a right triangle with hypotenuse equal to the line segment of interest, and use the Pythagorean Theorem to find the length of the hypotenuse.



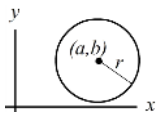
$$c = \sqrt{a^2 + b^2}$$

QUADRANTS

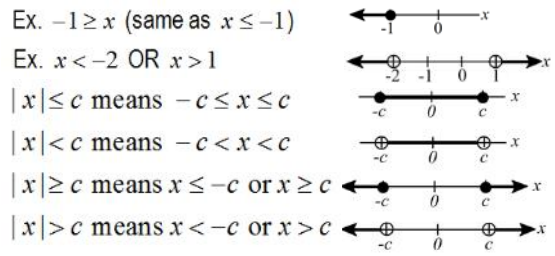


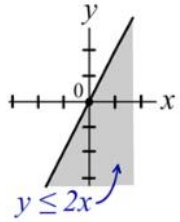
A CIRCLE with center at (a,b) and radius r has equation

$$(x-a)^2 + (y-b)^2 = r^2$$

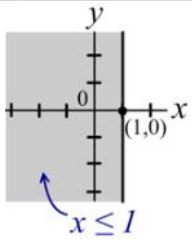


NUMBER LINE GRAPHS

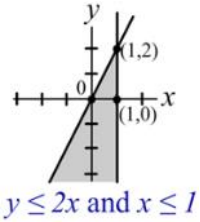




To show the region where $y \leq 2x$, in the coordinate plane, graph the line $y = 2x$ and shade the entire region BELOW this line.

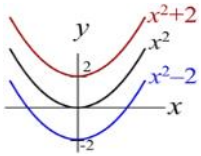


To show $x \leq 1$ graph the (vertical) line $x = 1$ and shade to the LEFT of the line.



To show the system, $y \leq 2x$ AND $x \leq 1$ graph BOTH lines and shade the region that is the INTERSECTION of the two individual regions. These points lie below y=2x AND left of x=1.

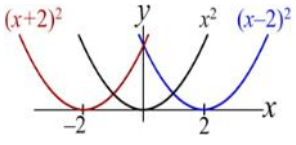
To shift a graph UP or DOWN, add or subtract a constant *c* (*c*>0):



To graph *f(x)+c*, shift the graph of *f(x)* UP *c* units.

To graph *f(x)-c*, shift the graph of *f(x)* DOWN *c* units.

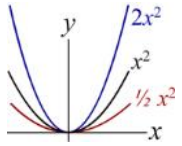
To shift a graph LEFT or RIGHT, subtract or add a constant to argument (*c*>0):



To graph *f(x-c)*, shift the graph of *f(x)* to the RIGHT *c* units.

To graph *f(x+c)*, shift the graph of *f(x)* to the LEFT *c* units.

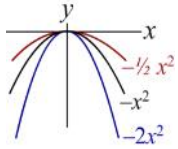
To STRETCH or COMPRESS a graph vertically (up and down), multiply by c:



If *c* >*1*, the graph of *cf(x)* looks like *f(x)* stretched vertically (up & down) by a factor of *c*.

For 0 < *c* < 1, *cf(x)* looks like *f(x)* compressed by *c*.

Multiplying by c<0, FLIPS a graph upside down:



For *c* < 0, the same rules apply, plus the graph is flipped upside down (what was positive becomes negative and vice versa).

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