Math EOG Cheat Sheet:

Volume

Cone- $V = \frac{1}{3}\pi r^2 h$ Cylinder- - $V = \pi r^2 h$ Sphere- $V = \frac{4}{3}\pi r^3$

Slope Formula:
$\frac{rise}{run}$

Slope-Intercept Form:
$y = mx + b$

Laws of Exponents

Multiplying Powers of the Same Base:

If you are **multiplying** powers of the **same base**, you just **add the exponents**.

$$(x^a)(x^b) = x^{a+b}$$
$$(xxx)(xxxxx) = x^8$$
or
$$(x^3)(x^5) = x^{3+5} = x^8$$

Raising a Power to a Power:

Any power of a power: you multiply the exponents.

$$(x^a)^b = x^{ab}$$

$$(x^2)^4 = x^{(2)(4)} = x^8$$
Or
$$(x^2)^4 = (x^2)(x^2)(x^2)(x^2) = (xx)(xx)(xx)(xx) = x^8$$

Zero Power of Exponent:

Anything to the 0 power is 1.

$$x^0 = 1$$

Dividing Powers of the Same Base:

Division with like bases you subtract exponents.

$$\frac{x^a}{x^b} = x^{a-b}$$

For example, $\frac{5^5}{5^3} = 5^{5-3} = 5^2 = 25$

$$\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5} = 5 \cdot 5 = 25$$

Negative Exponents:

A negative exponent means to **divide** by that number of factors **instead of multiplying**.

So 4^{-3} is the same as $\frac{1}{4^3}$, and $x^{-3} = \frac{1}{x^3}$.

As you know, **you can't divide by zero.** So there's a restriction that $x^{-n} = \frac{1}{x^n}$ only when x is not zero. When x = 0, x^{-n} is undefined.

Radicals:

<u>Simplifying Multiplying with Square Roots:</u>

$$(\sqrt{a})(\sqrt{b}) = \sqrt{ab}$$

For example:

$$\sqrt{12}\sqrt{8} = \sqrt{96}$$

<u>Simplifying Division with Square Roots:</u>

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

For example:

$$\sqrt{\frac{16}{9}} = \frac{\sqrt{16}}{\sqrt{9}} = \frac{4}{3}$$

Perfect Squares- numbers that when you take the square root, you get a whole number

$0^2 = 0$	$1^2 = 1$	$2^2 = 4$	$3^2 = 9$	$4^2 = 16$	$5^2 = 25$	$6^2 = 36$	$7^2 = 49$
$8^2 = 64$	$9^2 = 81$	$10^2 = 100$	$11^2 = 121$	$12^2 = 144$	$13^2 = 169$	$14^2 = 196$	
$15^2 = 225$	$20^2 = 400$	$25^2 = 625$	$30^2 = 900$				

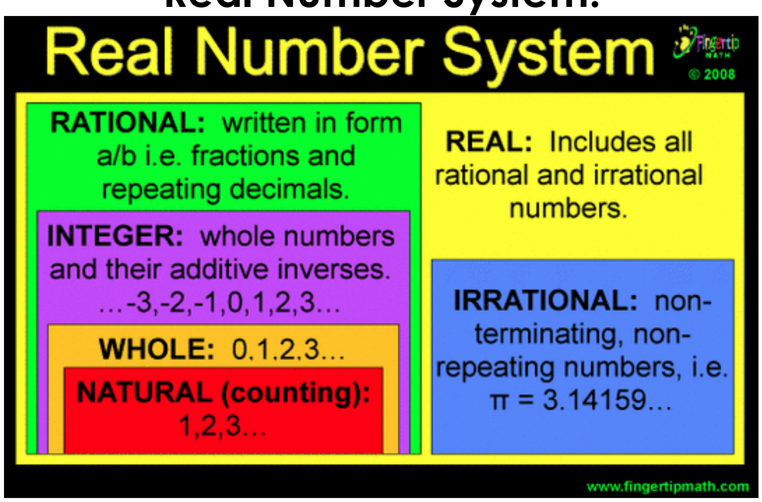
Perfect Cubes- numbers that when you take the cube root, you get a whole number

$1^3 = 1$	$2^3 = 8$	$3^3 = 27$	$4^3 = 64$	$5^3 = 125$	$6^3 = 216$	$10^3 = 1000$

How to Estimating Square Roots:

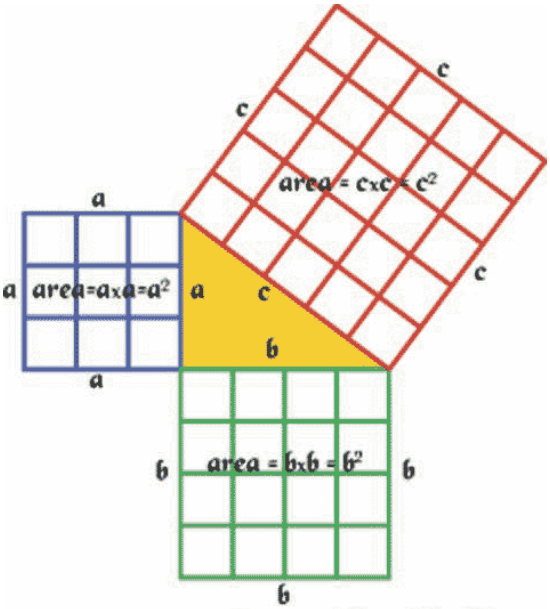
Instructions here!

Real Number System:



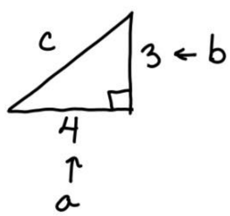
Pythagorean Theorem

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



Pythagoream Theorem: $c^2 = a^2 + b^2$

How to solve for hypotenuse:



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

$4^2 + 3^2 = c^2$

$16 + 9 = c^2$

$25 = c^2$

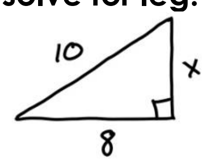
Find c by taking square root of both sides

$c^2 = 25$

$\sqrt{c^2} = \sqrt{25}$

$c = 5$ ← answer

How to solve for leg:



$\left.\begin{aligned} c &= 10 \\ a &= 8 \\ b &= x \end{aligned}\right\}$ → plug-in

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

$8^2 + x^2 = 10^2$

$64 + x^2 = 100$ ← get x^2 isolated

$-64 \qquad -64$

$x^2 = 36$

$\sqrt{x^2} = \sqrt{36}$

$x = 6$ ← answer

Systems of Equations

One Solution- two linear lines that cross only once
Infinite Solutions- two lines that are exactly the same
No Solution- Two parallel lines (lines never cross)

Elimination:

$$\left\{\begin{array}{l} x+y=2 \\ x-y=14 \end{array}\right\}$$

$$\begin{array}{r} x+y=2 \\ x-y=14 \\ \hline 2x \quad =16 \end{array}$$

← eliminate the y variable by adding equations

$2x=16$ ← solve for x

$x=8$ ← use to find y

$$\begin{array}{r} x+y=2 \\ 8+y=2 \\ -8 \qquad -8 \\ \hline y=-6 \end{array}$$

$\boxed{(8,-6) \text{ solution}}$

$$\begin{cases} -x+5y=8 \\ 3x+7y=-2 \end{cases} \overset{\times 3}{\Rightarrow} \begin{cases} -3x+15y=24 \\ 3x+7y=-2 \end{cases}$$

$$\begin{array}{r} -3x+15y=24 \\ +\quad 3x+7y=-2 \\ \hline 22y=22 \end{array}$$

$$\frac{22y}{22}=\frac{22}{22}$$

$$y=1$$

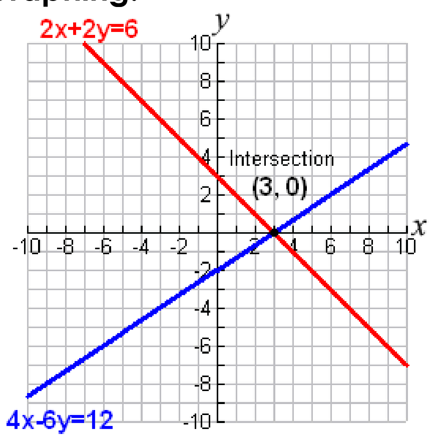
Substitution:

Directions: Solve the following system of equations using substitution.

-x +y = 1
2x +y = -2

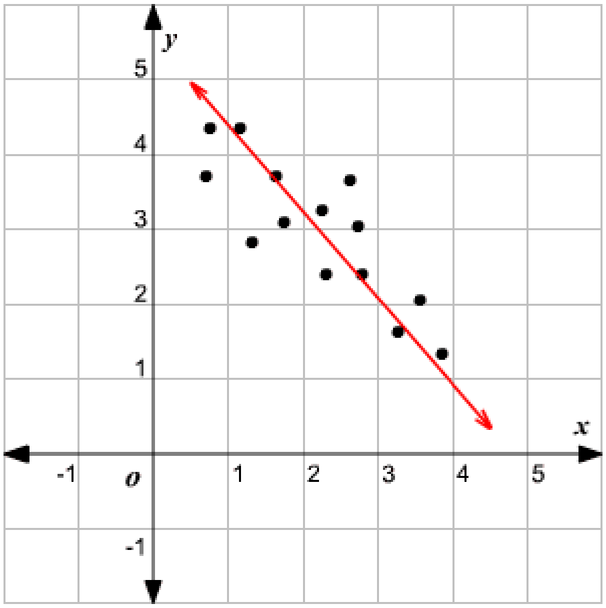
Step 1: -x +y = 1 -x +x +y = 1 +x y = 1 +x y = x +1	Solve 1 equation for 1 variable: (x = …) or (y=…) I chose the first equation because it was the easiest to rewrite. I added x to each side to rewrite this equation as y = x+1.
Step 2: 2x +y = -2 2x + x+1 = -2 3x + 1 = -2 3x +1 -1 = -2 -1 $\frac{3x}{3} = \frac{-3}{3}$ x = -1	Substitute this expression into the other equation and solve. Since I know that y = x+1, I substituted x+1 for y into the equation, 2x +y = -2. Then I solved for x and found x = -1
Step 3: y = x +1 y = -1 +1 y = 0	Now I need to find y. I know that x = -1. Substitute -1 for x into y = x +1. When I substitute -1 for x, I find y = 0.
Solution: (-1, 0)	My solution is the x and y values written as an ordered pair.
Step 4: Check -x +y = 1 -(-1) +0 = 1 1 =1 ☺	Substitute the values into each equation and check! 2x +y = -2 2(-1) +0 =-2 -2 = -2 ☺

Graphing:



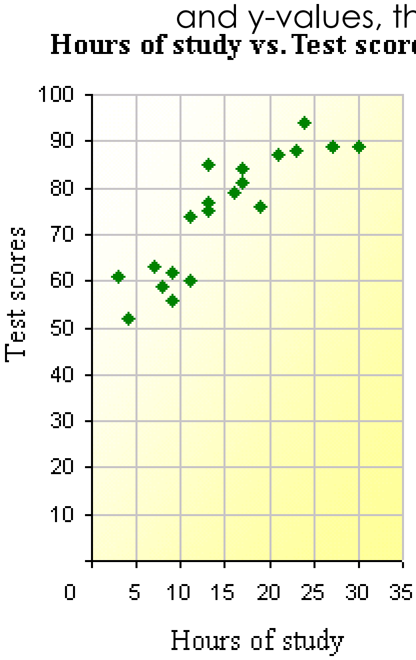
Scatterplots:

Line of best Fit:

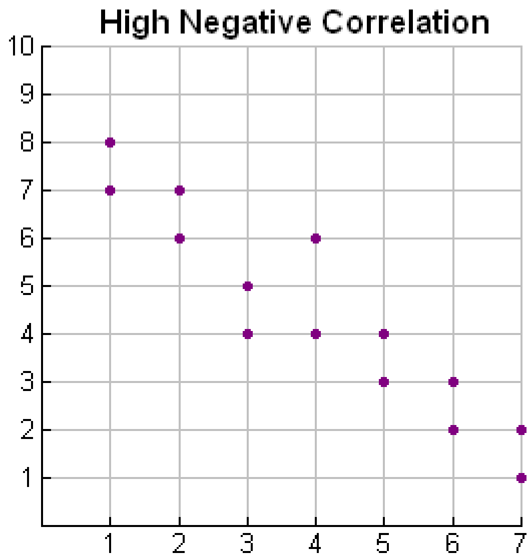


Correlation:

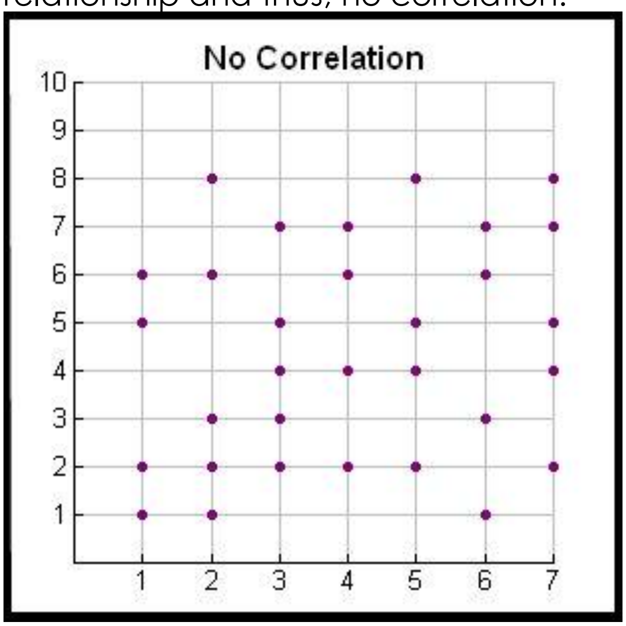
Positive Correlation-If the data points make a straight line going from the origin out to high x- and y-values, then the variables are said to have a positive correlation.



Negative Correlation-If the line goes from a high-value on the y-axis down to a high-value on the x-axis, the variables have a negative correlation.



No Correlation-If the data is all over the graph with no pattern then the variables have no relationship and thus, no correlation.



Scientific Notation:

"Handy" Helpful Tip 1

Keep in mind at all times the following:

Normal Numbers bigger than 1, or large numbers, always have a POSITIVE Power of 10.

$$6.2 \times 10^{1} = 62$$

$$1.496 \times 10^{8} = 149\ 600\ 000$$

Values smaller than 1, usually decimal values, always have a NEGATIVE Power of 10.

$$2.31 \times 10^{-3} = 0.00231$$

$$6.234 \times 10^{-1} = 0.6234$$

Scientific Notation

Scientific notation is used to make it easier to work with very large and very small numbers.

Changing large numbers to scientific notation

Step 1: Move the decimal to make a number between 1 and 10.

Step 2: Count how many places the decimal point moved.

Step 3: Write the number without all the 0s and multiply by a power of 10. The exponent tells how many places the decimal point was moved.

240,000

2.40000

2.4×10^{5}

Changing very small numbers

Move the decimal point to the right to make a number between 1 and 10.

Use a negative power of 10 to show how many places the decimal was moved.

0.000004.8

4.8×10^{-6}

Changing back to standard form

Step 1: Since the exponent is positive, make a larger number.

Step 2: Move the decimal point to the RIGHT the number of times indicated by the exponent, and then add zeros to fill in the spaces.

Step 3: Write the number in standard form.

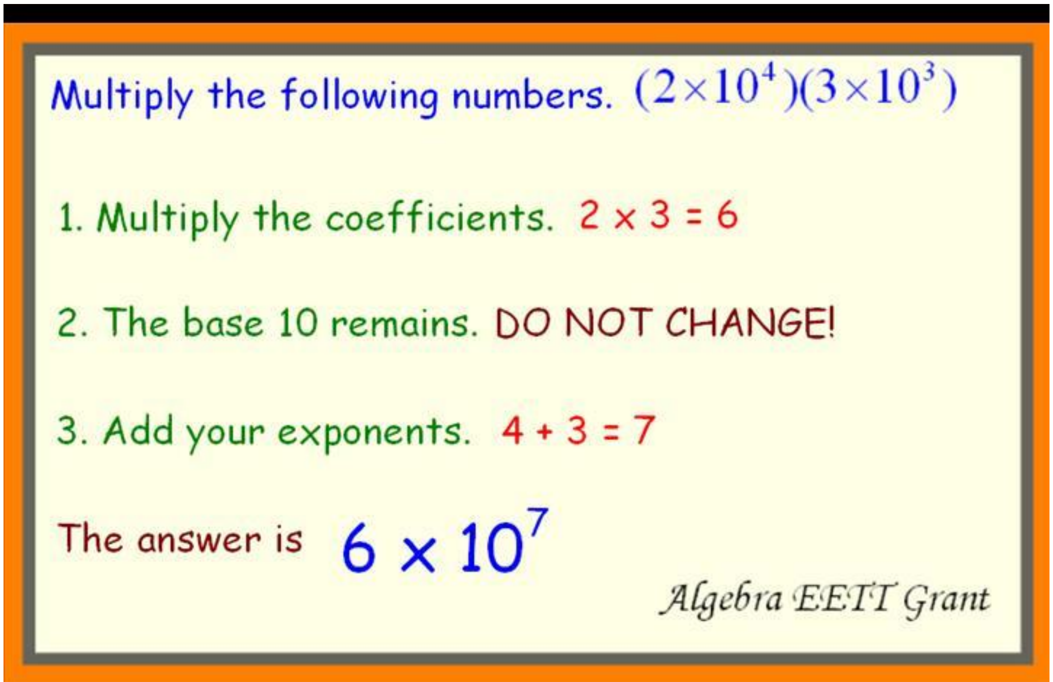
5.3×10^{7}

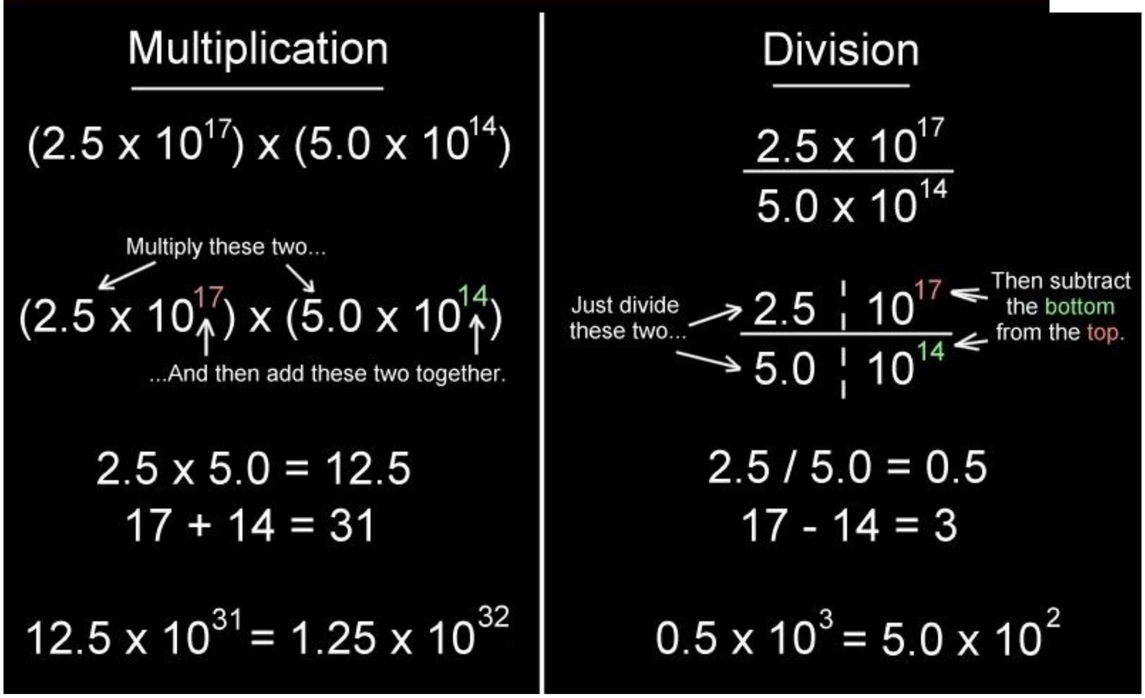
5.3000000

53,000,000

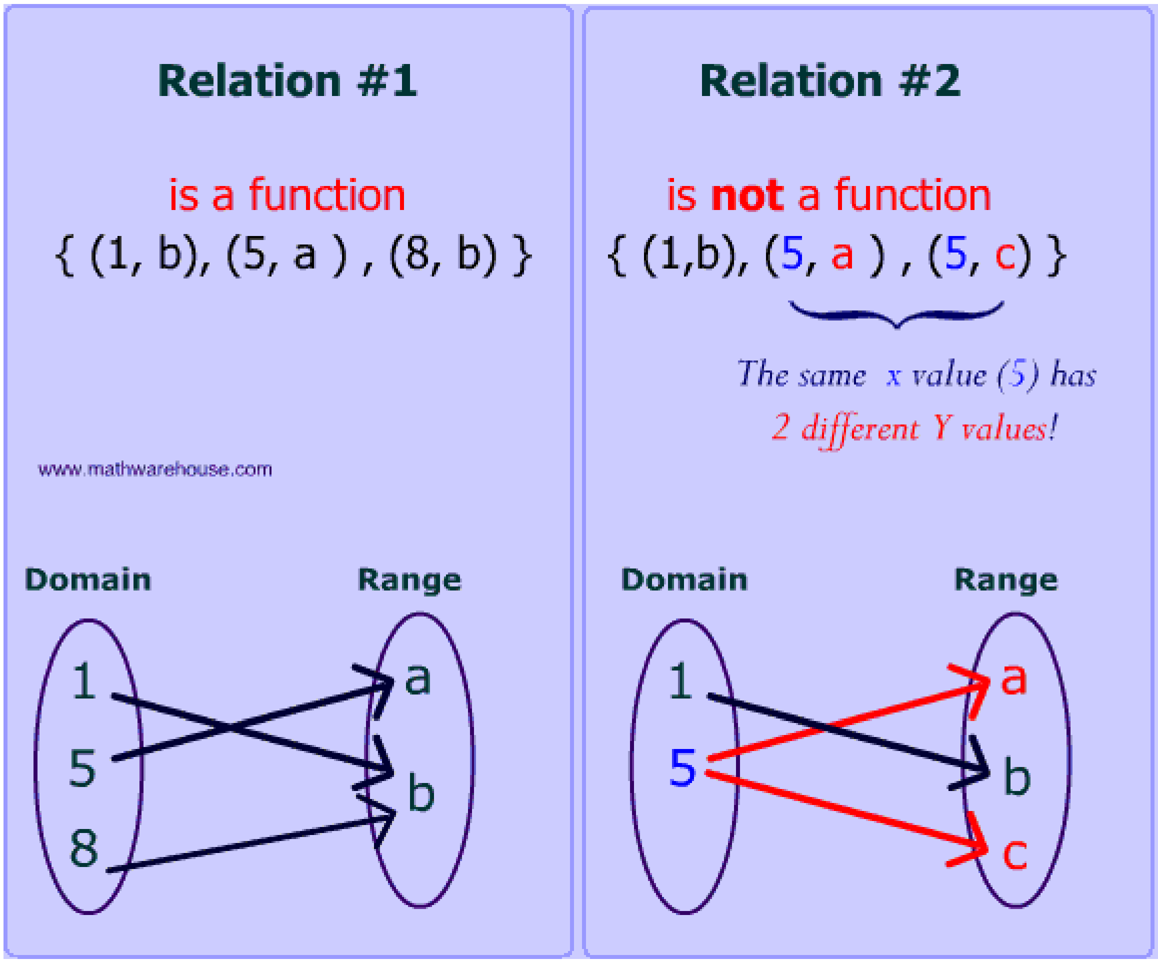
Convert to Scientific Notation

3.250,000,000.	0.0000004.
9 units to the LEFT	7 units to the RIGHT
LEFT → positive exponent	RIGHT → negative exponent
3.25×10^{9}	4×10^{-7}

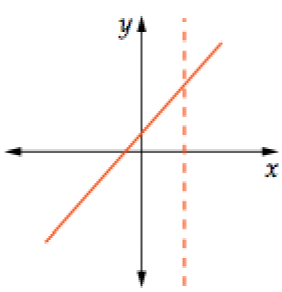




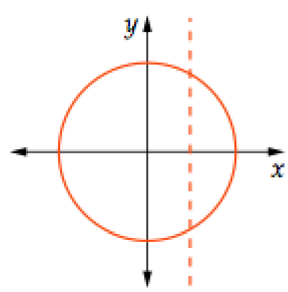
Functions
Linear Functions



Vertical Line Test



Cuts once, so graph represents a function.



Cuts twice, so graph does not represent a function.