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CC Algebra 1 Summary

Things to Know for the Common Core Algebra 1 Regents Exam

ABSOLUTE VALUE	**Equations**: Separate into 2 equations – one w/the original equation (without absolute value), the other with every term inside the absolute value negated. CHECK all solutions in the original equation. REJECT those that don't work. *Ex) Solve for x* $\|2x-3\|+x=3$ 2x – 3 + x = 3 → 3x = 6 → **x = 2** -2x + 3 + x = 3 → -x = 0 → **x = 0** CHECK: x = 2: $\|2(2)-3\|+2=3$; |1| + 2 = 3; 1 + 2 = 3 ☑ CHECK: x = 0: $\|2(0)-3\|+0=3$; |–3| + 0 = 3; 3 + 0 = 3 **Answer: {2, 0}**
AREA	**Square**: $A = s^2$ **Rectangle**: A = LW **Triangle**: $A = \frac{1}{2}bh$ **Circle**: $A = \pi r^2$ **Trapezoid**: $A = \frac{1}{2}h(b_1 + b_2)$
CALCULATOR	Key Strokes on Calculator: **Absolute Value**: [MATH] [→] [NUM] [abs(] **Factorial**: [MATH] [→] [→] [→] [PRB] [!] **Fractions**: to convert a decimal into a fraction [MATH] [FRAC →] **Graphing**: many graphs can be seen using [ZOOM] [6: ZOOMSTD] If not, adjust window using [WINDOW]
EXPONENTIAL GROWTH & DECAY	If something is **growing** at a rate of *r%*: $C(1 + r)^t$ If something is **decaying** at a rate of *r%*: $C(1 - r)^t$ where… C = current value r = % written as decimal (move 2 places LEFT) t = time <u>Compound Interest</u>: $A = P(1+\frac{r}{n})^{nt}$ where… A = Future Value P = Principal (original value) n = # of compoundings r = % written as decimal (move 2 places LEFT) t = time

FACTORING	**Greatest Common Factor**: whatever *all* the terms have in common goes in front of parentheses. What is left after dividing goes inside. *Ex)* $4a^3 + 6a^8 - 2a^2 = 2a^2(2a + 3a^6 - 1)$ **Difference of Two Squares**: There must be two terms separated by subtraction and both must be perfect squares (coefficients perfect & exponents even) *Ex)* $25x^6 - 49 = (5x^3 + 7)(5x^3 - 7)$ **Trinomial**: Looks like… $x^2 + \square x + \triangle$ find two numbers that Multiply to $\triangle$ and Add to $\square$. *Ex)* $x^2 - 2x - 24 = (x - 6)(x + 4)$ **Perfect Square Trinomials**: A trinomial where the number in $\triangle$ is a perfect square and the number in $\square$ is TWICE the square root of that number ex) $x^2 + 10x + 25$ $= (x + 5)^2$ ex) $x^2 - 16x + 64$ $= (x - 8)^2$ **Factor COMPLETELY**: First factor by greatest common factor then factor again by DOTS or Trinomial. Answer looks like: **__( )( )**
FRACTIONS	**Undefined** : Forget about the numerator. Set the denominator equal to zero and solve for x. *Ex)* $\frac{3x-1}{x+5}$ *is undefined when x + 5 = 0 meaning x = -5.* **Adding/Subtracting**: Find a common denominator and then multiply original fractions by what each is "missing". Add/Subtract numerators. Leave denominators alone. *Ex)* $\frac{x-2}{3} + \frac{x+1}{4} = \frac{4x-8}{12} + \frac{3x+3}{12} = \boxed{\frac{7x-5}{12}}$ **Multiplying**: Factor first, then cancel diagonally or up/down. Multiply straight across to get final answer. *Ex)* $\frac{x^2-4}{3x+6} \cdot \frac{4}{2x-4} = \frac{(x+2)(x-2)}{3(x+2)} \circ \frac{4}{2(x-2)} = \boxed{\frac{4}{3}}$ **Dividing**: Same as multiplying except FLIP the second fraction first. **Simplifying**: Any terms that have "+" or "-" between them must be factored first. Then cancel. *Ex)* $\frac{x^2-9x+20}{4x-20} = \frac{(x-4)(x-5)}{4(x-5)} = \frac{x-4}{4}$
FUNCTIONS	To determine if something is a function… **Graphs**: must pass the "Vertical Line Test" (no vertical line can ever intersect the graph more than once) **Points**: All x-values must be DIFFERENT to be a function. To evaluate a function… If f(x) is given and we want to find "f(some number)", just substitute the number in place of x on the right side of the equation. *Ex) If* $f(x) = 2x^2 - 3x + 1$, *then* $f(5) = 2(5)^2 - 3(5) + 1 = 36$

FUNCTIONS
(continued)

Piecewise Functions: functions that are defined differently for different values of x.

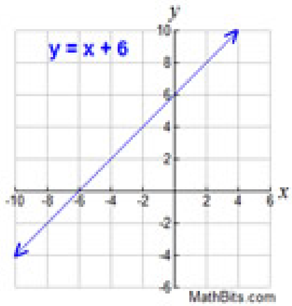
ex) If $f(x) = \begin{cases} 2x+3, x<1 \\ -x+7, x \geq 1 \end{cases}$ find f(2).

Since "2" is in the domain $x \geq 1$, we would use the function $-x+7$

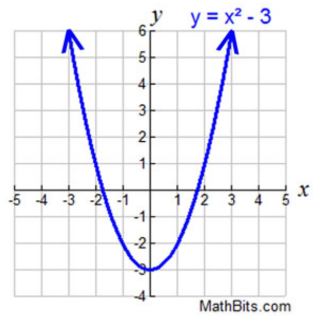
So $\mathrm{f}(2) = -(2)+7 = \boxed{5}$

To graph a piecewise function, graph the given equation ONLY for the values of x given. Make sure the graph satisfies the Vertical Line Test.

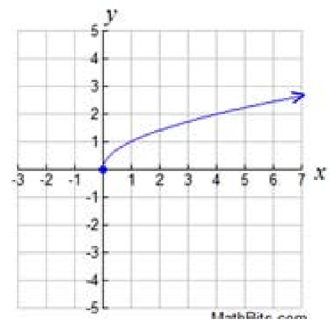
Domain of a Function: All possible x-values for the given function. Look at the graph and see how far left and right the graph goes.



Domain: All Real Numbers or $(-\infty, \infty)$

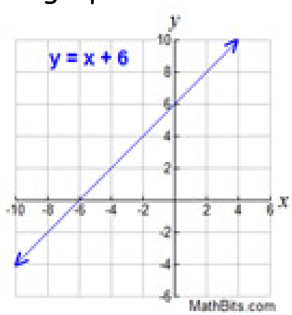


Domain: All Real Numbers or $(-\infty, \infty)$

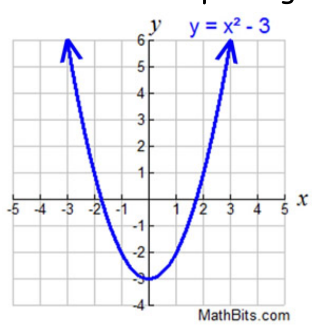


Domain: $x \geq 0$ or $[0, \infty)$

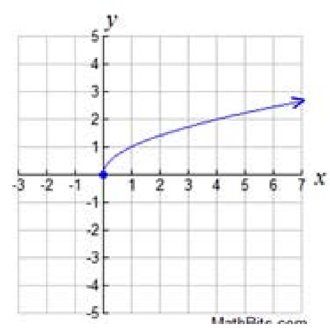
Range of a Function: All possible y-values for the given function. Look at the graph and see how far down and up the graph goes.



Range: All Real Numbers or $(-\infty, \infty)$



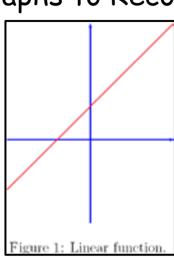
Range: $y \geq -3$ or $[-3, \infty)$



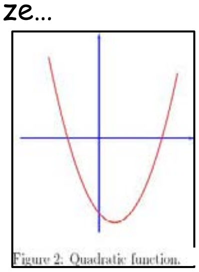
Range: $y \geq 0$ or $[0, \infty)$

GRAPHS

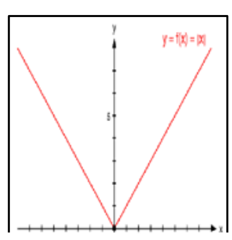
Graphs to Recognize…



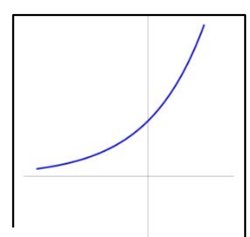
LINEAR
(line)



QUADRATIC
(u – shaped)

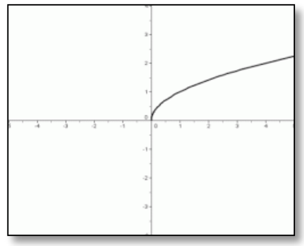


ABS. VALUE
(v – shaped)

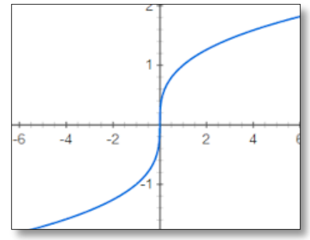


EXPONENTIAL
(hockey stick)

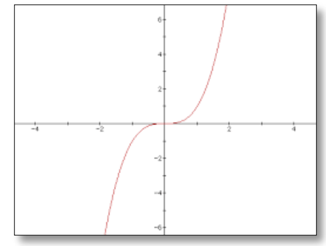
GRAPHS
(continued)



SQUARE ROOT
$y = \sqrt{x}$



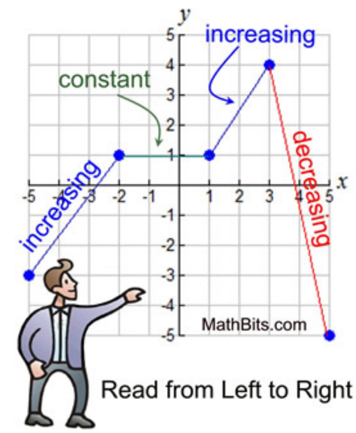
CUBE ROOT
$y = \sqrt[3]{x}$



CUBIC
$y = x^3$

Increasing and Decreasing Intervals:

The function (graph) at the right is increasing from the point (-5,-3) to the point (-2,1), which is described as increasing when $-5 < x < -2$. Using interval notation, it is described as increasing on the interval (-5,-2).



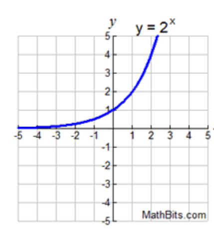
It also increases from the point (1,1) to the point (3,4), described as increasing when **$1 < x < 3$.** Using interval notation, it is described as increasing on the interval **(1,3)**.

The graph shown above is decreasing from the point (3,4) to the point (5,-5), described as decreasing when **$3 < x < 5$.** Using interval notation, it is described as decreasing on the interval **(3,5)**.

Intervals of increasing, decreasing or constant
ALWAYS pertain to *x*-values.
Do NOT read numbers off the *y*-axis.
Stay on the *x*-axis for these intervals!

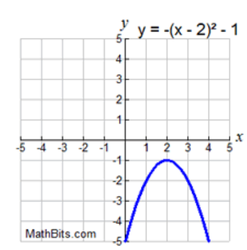
Positive and Negative:

Some functions are positive over their entire domain. (All y-values above the x-axis.)



positive: $-\infty < x < +\infty$
or "all Reals", or $(-\infty,+\infty)$

Some functions are negative over their entire domain. (All y-values below the x-axis.)

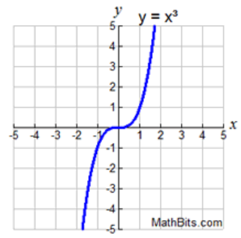


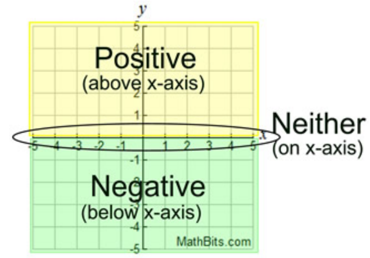
negative: $-\infty < x < +\infty$
or "all Reals", or $(-\infty,+\infty)$

GRAPHS
(continued)

Some functions have both positive and negative regions.
(y-values above and below x-axis)

positive: $x > 0$ or $(0,+\infty)$
negative: $x < 0$ or $(-\infty,0)$
(do not include zero)





INEQUALITIES

<u>Number lines</u>:

> **REMEMBER**: If divide by a negative number, the symbol switches.

- $>$ shade RIGHT w/open circle
- $<$ shade LEFT w/open circle
- $\geq$ shade RIGHT w/closed circle
- $\leq$ shade LEFT w/closed circle

<u>Both x and y</u>: These get graphed on xy-plane as lines (dotted or solid) and then a region gets shaded. *(If vertical line, follow above rules)*

$>$ dotted line/shade UP $<$ dotted line/shade DOWN
$\geq$ solid line/shade UP $\leq$ solid line/shade DOWN

INTERVAL NOTATION

<u>Parentheses</u>: means UNEQUAL (use open circles)
<u>Brackets</u>: means EQUAL (use closed circles)

> SHADE in between the 2 numbers on a # Line

Ex) Inequality notation: $-3 < x \leq 5$
interval notation: (-3, 5]

-3   5

LINES

<u>Equation of a Line</u>: $y = mx + b$ where m = slope and b = y-intercept
If Vertical line: *x = a number (slope is undefined)*
If Horizontal line: *y = a number (slope is zero)*

<u>Slope of a Line</u>: (using 2 points on the line)

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Parallel lines have <u>equal</u> slopes.
Perpendicular Lines have <u>negative reciprocal</u> slopes.
A positive slope looks like…   A negative slope looks like…

<u>To write the equation of a line</u>:
Step 1: Find slope (m).
Step 2: Find y- intercept (b) by plugging a point in for (x, y) and slope in for "m" into "y = mx + b" to solve for "b".

Ex) Write the equation of a line perpendicular to y = 2x + 7 that passes through the point (-6,4).

Step 1: since the slope of y = 2x + 7 is "2", the slope of a perp. line would be $m = -\frac{1}{2}$.
Step 2:

m = - ½
x = -6
y = 4

→

y = mx + b
4 = $(-\frac{1}{2})(-6)$ + b
4 = 3 + b
1 = b

→

$y = -\frac{1}{2}x + 1$

NUMBERS
& their Properties

<u>Types of Numbers</u>:

1. <u>Integers</u>: a whole number that can be positive, negative, or zero.
2. <u>Rational</u>: any number that can be written as a fraction
   (when written as a decimal it either ENDS or REPEATS)
3. <u>Irrational</u>: a number that cannot be written as a fractions
   (the decimal NEVER ends and NEVER repeats)

<u>Properties of Numbers</u>:

1. <u>Commutative</u>: when the numbers/variables change order
   Ex) $3 + 4 = 4 + 3$ **or** $a \cdot b = b \cdot a$
2. <u>Associative</u>: when the parentheses change what is inside them
   Ex) $3 + (4 + 5) = (3 + 4) + 5$ **or** $a \cdot (b \cdot c) = (a \cdot b) \cdot c$
3. <u>Distributive</u>: the number outside ( ) multiplies each term inside
   Ex) $3(4 + 5) = 3(4) + 3(5)$
4. <u>Identity</u>: for Addition, can add "0" and not change the number
   for Multiplication, can mult by "1" and not change number
   Ex) $3 + 0 = 3$ **or** $3 \cdot 1 = 3$
5. <u>Inverse</u>: for Addition, can add two numbers to get an answer of 0.
   for Multiplication, can multiply to get an answer of 1.
   Ex) $3 + (-3) = 0$ **or** $3 \cdot \frac{1}{3} = 1$
6. <u>Zero Property</u>: anything multiplied by 0 is 0 *Ex)* $3 \cdot 0 = 0$

PARABOLAS

<u>Equation of a Parabola</u>: $y = ax^2 + bx + c$

If "a" is positive, graph looks like…
The <u>Vertex</u> is a MINIMUM point

If "a" is negative, then
The <u>Vertex</u> is a MAXIMUM point

<u>Axis of Symmetry</u>: (the vertical line that passes through vertex)

** This value of x should be in the middle of the table**

$$x = \frac{-b}{2a}$$

<u>Vertex:</u> First find the axis of symmetry using the formula above, then plug that x-value into the parabola's equation to find "y". Vertex = (x, y)

Ex) Find the coordinates of the vertex of the parabola: $\mathbf{y = x^2 - 6x + 4}$

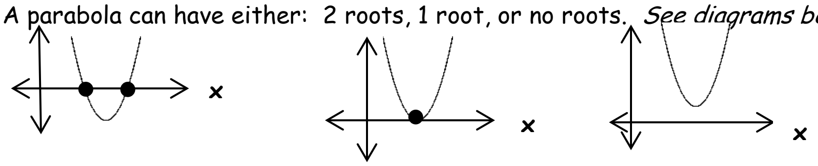
Axis of Symmetry: $a = 1, b = -6, c = 4$ → $x = \frac{-(-6)}{2(1)} = 3$

Vertex: $y = (3)^2 - 6(3) + 4$ → $y = -5$ **VERTEX: (3, -5)**

(*For vertex form of a Parabola – see "Quadratic Equations" on page 7*)

<u>Roots</u>: The values of *x* where the graph intersects the x-axis (y = 0)

A parabola can have either: 2 roots, 1 root, or no roots. *See diagrams below.*



To find the roots algebraically, set equation equal to zero and FACTOR. Set each factor equal to zero and solve for x.

PERCENTS	**Percent Problems**: set up this proportion and cross-multiply to solve $\frac{part}{whole} = \frac{\%}{100}$ or $\frac{is}{of} = \frac{\%}{100}$ In sales tax problems, whole = original and % is 100 + sales tax **Percent Error**: $\frac{\|Measured - Actual\|}{Actual} \cdot 100$ If it says **relative** error, don't multiply by 100 **Percent Increase/Decrease**: $\frac{\|Original - New\|}{Original} \cdot 100$
PERIMETER	**Square**: P = 4s **Rectangle**: P = 2L + 2W **Circle**: $C = \pi d$ or $2\pi r$ **All other shapes**: add all the sides
POLYNOMIALS	**Exponent Rules**: The coefficients always perform the operation in the problem, the exponents never do. **Multiplying Problems:** Coefficients Multiply, Exponents **ADD**, *Ex)* $6x^6 \cdot 2x^2 = 12x^8$ **Dividing Problems:** Coefficients Divide, Exponents SUBTRACT, *Ex)* $6x^6 \div 2x^2 = 3x^4$ **Adding/Subtracting Problems:** Coefficients Add/Subtract, Exponents STAY THE SAME, *Ex)* $6x^6 + 2x^6 = 8x^6$, *Ex)* $6x^6 + 2x^2 = 6x^6 + 2x^2$ **Zero and Negative Exponents**: $x^0 = 1$, $x^{-n} = \frac{1}{x^n}$, $\frac{1}{x^{-n}} = x^n$ **Notice the Difference**: $-3^2 \neq (-3)^2$ because $-3^2 = -9$ yet $(-3)^2 = +9$ **Adding/Subtracting Polynomials**: Only combine the *"LIKE TERMS"* (same variable and same exponent) *Ex)* $9x^3 + 7y^3 - x^3 - 6x^2 + 4y^3 = 8x^3 + 13y^3 - 6x^2$ **"Subtract/From" Problems**: The *"from"* expression goes first followed by a subtraction symbol and then the *"subtract"* expression in parentheses *Ex) Subtract* $2x^2 + 3x - 1$ *from* $x^2 - 5x - 7$ $= (x^2 - 5x - 7) - (2x^2 + 3x - 1) = x^2 - 5x - 7 - 2x^2 - 3x + 1$ $= \boxed{-x^2 - 8x - 6}$ **Multiplying Polynomials**: Each term in the first () multiplies each term in the 2nd (). To mult binomial by binomial use FOIL **(first, outer, inner, last)** *Ex) Find the product of* $3x - 4$ *and* $x + 5$. $= (3x - 4)(x + 5) = 3x^2 + 15x - 4x - 20 = \boxed{3x^2 + 11x - 20}$
PROPORTION	**Proportion**: when two fractions (ratios) are equal to one another If $\frac{a}{b} = \frac{c}{d}$ → (cross multiply) $a \cdot d = b \cdot c$ **Direct Variation**: If x varies directly as y, then: $\frac{x}{y} = \frac{x}{y}$ *Ex) If x varies directly as y and x = 4 when y = 6, find y when x = 10.* $\frac{4}{6} = \frac{10}{y}$ $4 \cdot y = 6 \cdot 10$ $y = 15$

QUADRATIC EQUATIONS

<u>Quadratic Equation</u>: an equation that has x^2 in it. There are 3 ways to solve a quadratic equation.

<u>TO SOLVE BY FACTORING</u>

Step 1: Get one side equal to ZERO (try to get x^2 to the side where it's positive)
Step 2: FACTOR (by GCF, DOTS, or TRInomial)
Step 3: Set each factor equal to zero and solve for x.

<u>TO SOLVE USING QUADRATIC FORMULA</u>

Step 1: Get one side equal to ZERO
Step 2: Determine "a", "b", "c" then use the formula below

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

<u>TO SOLVE BY **COMPLETING THE SQUARE**</u>:

Step 1: Divide by the number in front of x^2. Step 2: Keep all terms with x on the left and move constant to right side of =. Step 3: Set up a place ♡ holder on each side to fill in with the missing number $\left(\frac{b}{2}\right)^2$. Step 4: Rewrite the left side as $(x + \frac{b}{2})^2$. Step 5: Square root both sides – this will get rid of the "*squared*" on left side. **Include a** " $\pm$ " **on right side**. Step 6: Get x alone and simplify if possible.

Ex) Solve by completing the square: $2x^2 - 6x - 7 = 0$

$x^2 - 3x - \frac{7}{2} = 0$ *(Divide by 2)*

$x^2 - 3x = \frac{7}{2}$ *(Move constant)*

$x^2 - 3x + ♡ = \frac{7}{2} + ♡$ *(place holder)*

$x^2 - 3x + \frac{9}{4} = \frac{7}{2} + \frac{9}{4}$ *(b = -3 ⟶ $\left(\frac{-3}{2}\right)^2 = +\frac{9}{4}$)*

$\left(x - \frac{3}{2}\right)^2 = \frac{7}{2} + \frac{9}{4}$ (*left side is perfect square*)

$\left(x - \frac{3}{2}\right)^2 = \frac{23}{4}$ *(simplify)*

$\sqrt{\left(x - \frac{3}{2}\right)^2} = \pm\sqrt{\frac{23}{4}}$ *(square root- don't forget $\pm$ on right)*

$x - \frac{3}{2} = \pm\sqrt{\frac{23}{4}}$ (drop the squared on left)

$x = \frac{3}{2} \pm \sqrt{\frac{23}{4}} = \boxed{\frac{3}{2} \pm \frac{\sqrt{23}}{2} \text{ or } \frac{3 \pm \sqrt{23}}{2}}$

Every quadratic equation has <u>two</u> solutions. The graph of a quadratic equation is a parabola and the solutions represent its ROOTS.

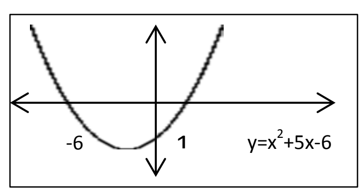
Ex) Solve: $x^2 - 2x = 2x^2 + 3x - 6$

$-x^2 + 2x \quad -x^2 + 2x$

$0 = x^2 + 5x - 6$

$0 = (x + 6)(x - 1)$

$x + 6 = 0$	$x - 1 = 0$
x = -6	**x = 1**



QUADRATIC EQUATIONS (continued)	**Nature (Type) of Roots**: to determine the type of roots a quadratic eqn. has (without actually finding them), use the **Discriminant** = $b^2 - 4ac$ Discriminant $b^2 - 4ac$ is… → Roots would be… NEGATIVE → Imaginary ZERO → Equal (Real, Rational, & Equal) POSITIVE PERFECT SQUARE → Rational & Unequal (Real, Rational, & Unequal) POSITIVE but NOT a PERFECT SQUARE → Irrational (Real, Irrational, & Unequal) **Vertex Form of a Parabola**: $y = a(x-h)^2 + k$ where vertex = (h, k) *NOTE: If equation is NOT in this form, complete the square* **Range of Quadratics Using Vertex Form:** Identify the vertex from the equation, identify whether the vertex is a minimum or maximum point and write an inequality of the range. *Ex)* Identify the range of the function $g(x) = 5(x-2)^2 - 7$ The vertex is (2, -7). It is a minimum because the leading coefficient is positive. -7 is the lowest y-value so, the range is $y \geq -7$ or written in interval notation $[-7, \infty)$ *Ex)* Identify the range of the function $f(x) = -2(x+4)^2 + 6$ The vertex is (-4, 6). It is a maximum because the leading coefficient is negative. 6 is the highest y-value so, the range is $y \leq 6$ or written in interval notation $(-\infty, 6]$
RADICALS	**Perfect Squares**: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169… **Simplifying Radicals**: find two numbers that multiply to the number under the radical where one number must be a *perfect square*. (If there is a coefficient, it will multiply) *Ex)* $7\sqrt{54} = 7\sqrt{9}\sqrt{6} = 7 \cdot 3\sqrt{6}$ $= 21\sqrt{6}$ **Adding/Subtracting**: Two radicals must have the SAME number under the radical. If so, add/subtract coefficients and leave common radical alone. *Ex)* $\sqrt{27} - 5\sqrt{12} = \sqrt{9}\sqrt{3} - 5\sqrt{4}\sqrt{3}$ $= 3\sqrt{3} - 5 \cdot 2\sqrt{3} =$ $\boxed{-7\sqrt{3}}$ **Multiplying/Dividing**: Any two radicals can mult/divide (do not have to be the same). Mult/divide the coefficients and mult/divide the radicands. *Ex) Multiply and express result in simplest radical form:* $9\sqrt{6} \cdot 7\sqrt{3} = 63\sqrt{18} = 63\sqrt{9}\sqrt{2} = 63 \cdot 3\sqrt{2} = \boxed{189\sqrt{2}}$ *Ex) Divide:* $\frac{6\sqrt{32}}{2\sqrt{2}} = 3\sqrt{16} = 3 \cdot 4 = \boxed{12}$

SEQUENCES

Arithmetic Sequence: when the pattern is ADDING.

d = difference b/w terms
a_1 = first term
n = number of term asked for

To find the n^{th} ARITHMETIC term:

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

Ex) Find the 100^{th} term of: 3, 7, 11, 15, 19, …

Here: n = 100, a_1 = 3, d = 4 ➡ $a_{100} = 3 + (100-1)(4) = 399$

Geometric Sequence: when the pattern is MULTIPLYING.

r = ratio b/w terms (if not obvious – divide any term by the previous one)
a_1 = first term
n = number of term asked for

To find the n^{th} GEOMETRIC term:

$$a_n = a_1(r)^{n-1}$$

Ex) Find the 7^{th} term of: 6, 4, $\frac{8}{3}$, $\frac{16}{9}$,…

Here: n = 7, a_1 = 6, r = 2/3 ➡ $a_7 = 6(\frac{2}{3})^{7-1} = \frac{128}{243}$

Recursive Sequences: a term is found by knowing the term before it
The first term "a_1" will be given along with a formula to find "a_n" given "a_{n-1}"

Ex) If $a_1 = 2$ and $a_n = 5a_{n-1} + 3$, find the first 4 terms.

Need to find a_1, a_2, a_3, and a_4

$a_1 = 2$
a_2 = plug in n to be 2 = $5a_{2-1} + 3 = 5a_1 + 3 = 5(2) + 3 = 13$
a_3 = plug in n to be 3 = $5a_{3-1} + 3 = 5a_2 + 3 = 5(13) + 3 = 68$
a_4 = plug in n to be 4 = $5a_{4-1} + 3 = 5a_3 + 3 = 5(68) + 3 = 343$

2, 13, 68, 343

SETS

$\cup$ = UNION = combine the sets together (put in order, don't repeat)

$\cap$ = INTERSECTION = what both sets have in common (if nothing, write ∅)

$\bar{A}$ = COMPLEMENT of SET A = everything that set A is missing from the Universe "$\mathcal{U}$"

Ex) If $\mathcal{U}$ = {1, 2, 3, 4, 5, 6}
A = {2, 5}
B = {3, 5, 6}
Then A ∪ B = **{2, 3, 5, 6}**
A ∩ B = **{ 5 }**
$\bar{B}$ = **{1, 2, 4}**

SPEED

Formula: $d = rt$

"r and t" vary inversely

where…
d = distance (possible units = *miles*)
r = rate (possible units = $\frac{miles}{hour}$)
t = time (possible units = *hours*)

STATISTICS

Mean: the average

To find the Mean: add all the numbers that divide by how many (“n”).

To find missing data: Use the fact that (Mean) · (n) = SUM

To find the missing number, see what’s missing to get this sum.

Ex) 78, 92, 85, 97, _?_ Find ? if mean is 90.

(90)·(5) = 450 = SUM (of all 5 numbers)

78+92+85+97 = 352 (so far, of the 4 known numbers)

450 – 352 = 98

Median: the middle number (once the data is arranged in order). If there are two numbers in the middle, find the average of them.

Mode: the number that appears MOST often

(there can be no mode or even more than 1 mode)

Range: HIGHEST – LOWEST

Outlier: any number that is far away from the rest. When there are outliers, the MEDIAN best represents the data.

Quantitative vs. Qualitative: QUANTITATIVE = data is numbers
QUALITATIVE = data isn’t numbers

Univariate vs.Bivariate: UNI = one set of #’s; BI = two sets of #’s

Causal Relationship: where one thing actually causes the other.

Correlation: three types **POSITIVE** – as one increases, so does the other
NEGATIVE – as one increases, the other decreases
NONE – scatter plot does NOT look like a line

Stem and Leaf Plot: the first digit(s) go in front of the line, the last digit goes after the line. DON’T FORGET A KEY!

Ex) If data were: 83, 88, 88, 92, 100 then plot would look like…

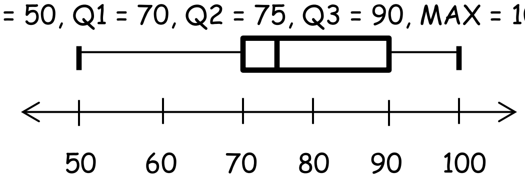
8	3 8 8
9	2
10	0

Key: 9 | 2 = 92

Box and Whiskers Plot: Include an equally spaced number line on Bottom then show **MIN**, **Q1**, **Q2** (same as median), **Q3**, and **MAX**.

(see calculator instructions below)

Ex) If MIN = 50, Q1 = 70, Q2 = 75, Q3 = 90, MAX = 100 plot looks like



Note: between any 2 of these scores 25% of data lie

STATISTICS
(continued)

Mean, Median, Range, & Standard Deviation on Calculator:

Step 1: Enter all data under L_1 and frequencies (if there are any) under L_2 using [STAT] [EDIT]

Step 2: Calculate these measures of central tendency and dispersion by

[STAT] [CALC] [1 – VAR STATS] [L_1] [,] [L_2] (only if frequencies)

Mean: $\bar{X}$

Median: Med

Range: maxX – minX

Interquartile Range: $Q_3 - Q_1$

Standard Deviation: σ_x (if it is a population)

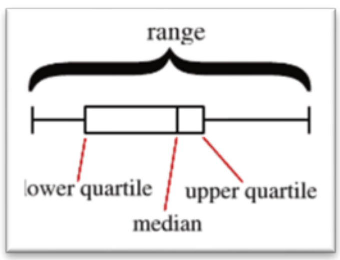
S_x (if it is a sample)

To create a Box and Whiskers Plot on Calculator:

Find the 5 calculations (MIN, Q1, MED, Q3, MAX) using steps 1 and 2 above. To create plot: [2nd] [STATPLOT] [PLOT 1]

Choose: [ON]

Type: choose the 5th graph, then graph by hitting [ZOOM] [ZOOMSTAT]



Regressions: used to find the equation of the line of "best fit" given data

Step 1: Enter data [STAT] [EDIT]

Step 2: Create the scatterplot **(Make sure x's are in L_1 and y's are in L_2)**

[2nd] [STATPLOT] [PLOT 1] **Choose:** [ON]

For type choose 1st graph

Step 3: Graph [ZOOM] [ZOOMSTAT]

Step 4: To write the equation of the line

[STAT] [➡] [CALC] [LinReg (ax + b)] [ENTER]

Note that "a" is the slope (m)
and b is the y-intercept

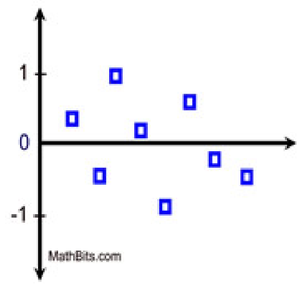
Residuals: Residuals help to determine if a curve (shape) is appropriate for the data. (linear versus non-linear)

A residual plot is a scatter plot that shows the residuals on the vertical axis and the independent variable on the horizontal axis. The plot will help you to decide on whether a linear model is appropriate for your data.

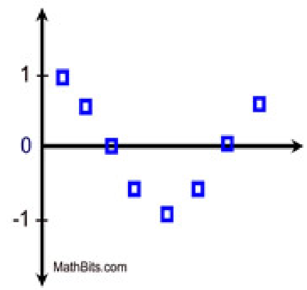
STATISTICS
(continued)

Appropriate linear model:
when plots are randomly placed, above and below *x*-axis ($y = 0$)

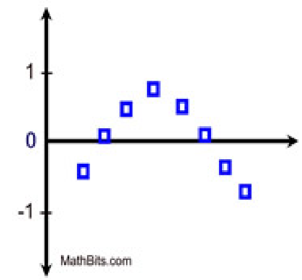
Appropriate non-linear model: when plots follow a pattern, resembling a curve



Random, No Pattern
"Linear Appropriate"



U-shaped Pattern
"Non-Linear Appropriate"



Inverted U-shaped Pattern
"Non-Linear Appropriate"

SYSTEMS
of Equations (=)
or Inequalities (<)

Two Inequalities: Graph lines on xy-plane then shade according to rules listed under "INEQUALITIES". The solution set is the region on the graph that was shaded by both inequalities. Label it "*S*".

Two Equations: Three ways to solve…

Graphically: graph each equation and find the point(s) of intersection
It could be a parabola and a line (if there's x^2) or two lines (if no x^2)

Algebraically using SUBSTITUTION: used when the system is Quadratic/Linear (one equation has x^2) or whenever one equations has either *x* or *y* alone. Substitute whatever it is equal to into the other equation, then solve. Remember to find both x and y.

Algebraically using ELIMINATION: (not used in Quadratic/Linear) Multiply each equation by a number that will get the coefficients of either x or y to be the **same number but with opposite signs**. Then add the two equations and one variable will cancel. Remember to find both x and y.

Ex) The algebraic method that would work best on each example is…

$2x + 3y = 5$
$x = \boxed{4y + 8}$

use Substitution since x is alone

$y = \boxed{x^2 + 2x - 3}$
$3y - 2x = 5$

use Substitution since Quadratic

7$(2x + 3y = 5)$
-3$(5x + 7y = 10)$

use Elimination to get y to cancel

WORD PROBLEMS	Always start with a "Let" statement that states what *x* represents. **<u>Consecutive Integer Problems</u>**: *Consecutive*: **Let x = 1st; x + 1 = 2nd; x + 2 = 3rd** — *Consecutive Even / Odd*: **Let x = 1st; x + 2 = 2nd; x + 4 = 3rd** **<u>Deciding "who" is x</u>**: whenever two quantities are compared to one another, the one at the END OF THE SENTENCE is "x". *Ex) The larger of two numbers is 3 less than twice the smaller. If their sum is 27, find each number.* **x = smaller #** **2x – 3 = larger #** SUM = 27 x + (2x – 3) = 27 3x – 3 = 27 3x = 30 x = 10 **10** = smaller # 2(10) – 3 = **17** = larger # *Ex) The width of a rectangle is 4 more than the length. If the perimeter is 36 cm., find the dimensions of the rectangle.* **x = length** **x + 4 = width** PERIMETER = 36 2L + 2W = 36 2(x) + 2(x + 4) =36 2x + 2x + 8 = 36 4x + 8 = 36 4x = 28 x = 7 **7** = length**;** **11** = width