

What students need to know for...

PRE-CALCULUS

Students expecting to take Pre-Calculus should demonstrate the ability to:

General:

- keep an organized notebook
- take good notes
- complete homework every night
- be active learners
- ask questions and participate in class
- seek help outside of class if needed
- work with others
- work with and without a calculator

Specific Math Skills

1) Tools of Algebra

- define and use basic concepts and properties of real numbers, operations, and equalities.
- solve and graph one-variable equations with/without absolute value.

2) Linear Relationships and Functions

- define and specify relations and functions by verbal descriptions, lists, and tables
- determine equations for specific functions and relations
- recognize slope as rate of change of one variable in terms of another
- write and interpret a direct variation.

3) Quadratic Equalities and Functions

- write quadratic functions in standard form
- graph quadratic functions to get parabolas
- identify axis of symmetry, intercepts and vertices of parabolas
- solve expressions with radicals
- solve quadratic equations by factoring, finding square roots, graphing, completing the square, quadratic formula
- identify and graph complex numbers
- add, subtract, multiply and divide complex numbers

4) Radical Functions and Rational Exponents

- add, subtract, multiply and divide radical expressions
- rationalize denominators
- simplify expressions with rational exponents
- add, subtract, multiply and divide functions

5) Exponential and Logarithmic Functions

- graph exponential functions
- solve exponential and logarithmic equations

Review Problems:

*NOTE: Show all of your work. Your teacher may give a quiz on this material at the beginning of the year. Don't forget to use the reference sheet on page 2. **You should "Google" the topic if you are unsure how to complete the examples. Khanacademy.org has some good instructional videos.**

Name _____

Date _____

SKILL 1: Tools of Algebra

Solve each formula for the indicated variable:

a) $A = \frac{1}{2}bh$, for h

Answer: $A = \frac{1}{2}bh$ Original equation

$2 \times A = 2 \times \frac{1}{2}bh$ Multiply both sides with 2 to clear the fraction

$2A = bh$ Simplify

$\frac{2A}{b} = \frac{bh}{b}$ Divide both sides by b

$\frac{2A}{b} = h$ Simplify

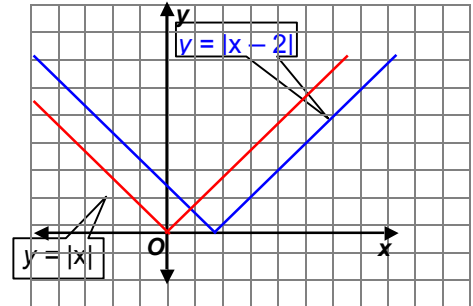
b) $V = \pi r^2 h$, for h

c) $V = s^2 + \frac{1}{2}sh$, for h

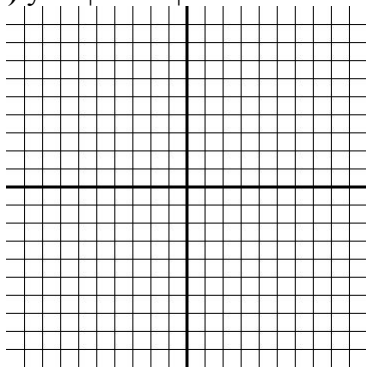
SKILL 2: Linear Relationships and Functions

Describe the translation in each case then graph the function.

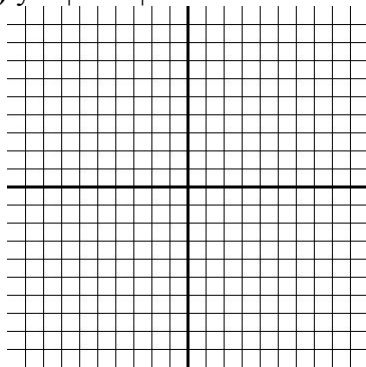
a) $y = |x - 2|$. **Answer:** The graph of $y = |x - 2|$ is a translation of the graph of $y = |x|$ moved right 2 units.



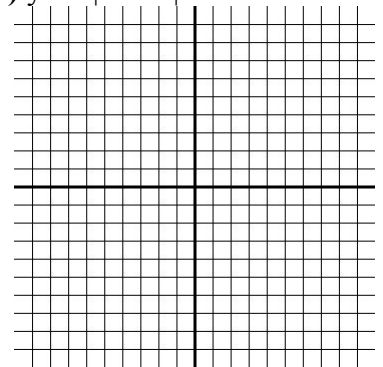
b) $y = -|x + 6|$



c) $y = |5 - x| + 3$



d) $y = 2|x + 3| - 8$



SKILL 3: Quadratic Equalities and Functions

Solve each equation by factoring.

a) $5x^3 - 30x^2 = 0$ **Answer:** $5x^3 - 30x^2 = 5x^2(x) - 5x^2(6) = 0$ Factor the GCF.
 $= 5x^2(x - 6) = 0$ Distributive Property

$5x^2 = 0$ or $x - 6 = 0$ Set each factor equal 0
 $x = 0$ or $x = 6$ Solve each equation

b) $3x^2 - 6x - 4 + 2x = 0$ c) $x^2 + 6x + 8 = 0$ d) $3x^2 = 16x + 12$

Solve each Equation using Quadratic Formula

a) $2x^2 - x = 15$

Answer:

First, write the equation in the form $ax^2 + bx + c = 0$ and identify a , b , and c .

$$ax^2 + bx + c = 0$$

$$\downarrow \quad \downarrow \quad \downarrow$$
$$2x^2 - x = 15 \rightarrow 2x^2 - 1x - 15 = 0$$

Then, substitute these values into the Quadratic Formula.

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

Quadratic Formula

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-15)}}{2(2)}$$

Replace a with 2, b with -1 , and c with -15 .

$$x = \frac{1 \pm \sqrt{1 + 120}}{4}$$

Simplify.

$$x = \frac{1 \pm \sqrt{121}}{4}$$

Simplify.

$$x = \frac{1 \pm 11}{4}$$

$$\sqrt{121} = 11$$

$$x = \frac{1 + 11}{4} \quad \text{or} \quad x = \frac{1 - 11}{4}$$

Write as two equations.

$$= 3 \quad \quad \quad = -2.5$$

Simplify.

The solutions are -2.5 and 3 . Check by substituting each of these values into the original equation.

b) $x^2 - 4x + 3 = 0$

Simplify each Complex expression:

a) $(-7 + 5i) + (12 + 3i)$

Answer:

$$\begin{aligned} &(-7 + 5i) + (12 + 3i) \\ &= (-7 + 12) + (5 + 3)i \\ &= 5 + 8i \end{aligned}$$

Commutative and Associative Properties
Simplify.

b) $(2 + 4i) + (4 - 2i)$

c) $(3 + \sqrt{-4})(4 + \sqrt{-1})$

SKILL 4: Radical Functions and Rational Exponents

Simplify each radical expression:

a) $\sqrt{72m^7}$

Answer:

$$\begin{aligned} \sqrt{72m^7} &= \sqrt{2 \cdot 6^2 \cdot (m^3)^2 \cdot m} \\ &= \sqrt{2} \cdot \sqrt{6^2} \cdot \sqrt{(m^3)^2} \cdot \sqrt{m} \\ &= 6m^3 \sqrt{2m} \end{aligned}$$

Factor into squares where possible.

Product Property of Radicals

Simplify.

b) $\sqrt{36} = \underline{\hspace{2cm}}$ $-\sqrt{36} = \underline{\hspace{2cm}}$ $\sqrt{-36} = \underline{\hspace{2cm}}$ $-\sqrt[4]{81} = \underline{\hspace{2cm}}$

c) $\sqrt{16x^2} = \underline{\hspace{2cm}}$ $\sqrt{x^8 y^{18}} = \underline{\hspace{2cm}}$ $\sqrt[3]{x^8 y^{12}} = \underline{\hspace{2cm}}$

Solve each equation. Include ALL solutions for x.

a) $3\sqrt{x} + 3 = 15$

b) $(x + 5)^{\frac{2}{3}} = 4$

c) $\sqrt{x + 7} - x = 1$

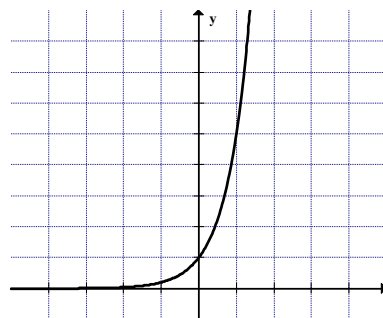
SKILL 5: Exponential and Logarithmic Functions

Graph each exponential function. Find the y-intercept, and state the domain and range.

a) $y = 5^x$.

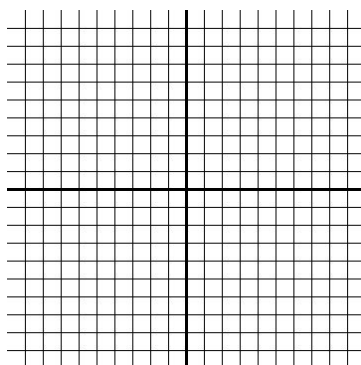
Answer:

x	5^x	y
-2	5^{-2}	$\frac{1}{25}$
-1	5^{-1}	$\frac{1}{5}$
0	5^0	1
1	5^1	5
2	5^2	25
3	5^3	125



Graph the ordered pairs, and connect the points with a smooth curve.
 The graph crosses the y-axis at 1, so the y-intercept is 1.
 The domain is all real numbers, and the range is all positive real numbers

b) $y = \left(\frac{1}{4}\right)^x$.



Solve each exponential function

a) $\left(\frac{1}{2}\right)^{n-1} = 16$

Answer:

$\left(\frac{1}{2}\right)^{n-1} = 16$ Original equation

$(2^{-1})^{n-1} = 2^4$ Rewrite $\frac{1}{2}$ as 2^{-1} and 16 as 2^4 so each side as the same base.

$2^{-n+1} = 2^4$ Power of a Power

$-n + 1 = 4$ Property of Equality for Exponential Functions

$-n = 3$ Subtract 1 from each side.

$n = -3$ Divide each side by -1 .

b) $5^{5n+1} = 125^{n-2}$

Solve each Logarithmic Equation

a) $\log_{\frac{1}{8}} a = \frac{2}{3}$

Answer: $\log_{\frac{1}{8}} a = \frac{2}{3}$ Original equation

$a = \left(\frac{1}{8}\right)^{\frac{2}{3}}$ Definition of logarithm

$a = \left[\left(\frac{1}{2}\right)^3\right]^{\frac{2}{3}} \quad \frac{1}{8} = \left(\frac{1}{2}\right)^3$

$a = \left(\frac{1}{2}\right)^2$ or $\frac{1}{4}$ Power of a Power

b) $\log_6 (a^2 - 15) = \log_6 (2a)$