Precalculus 1.1 Key Points

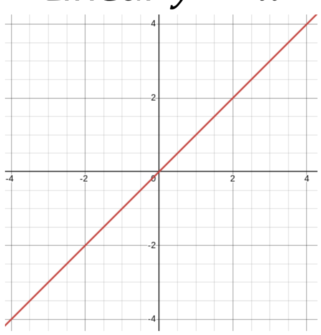
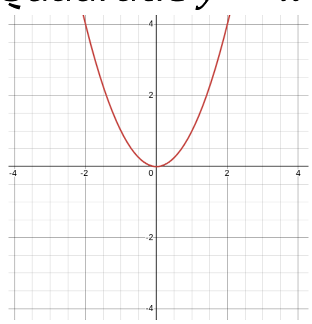
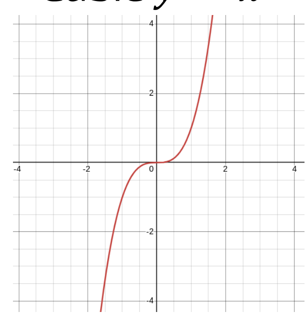
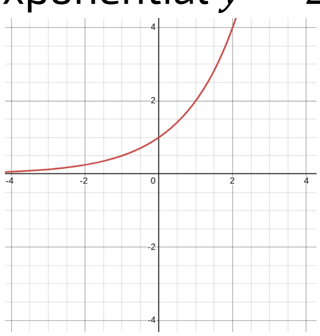
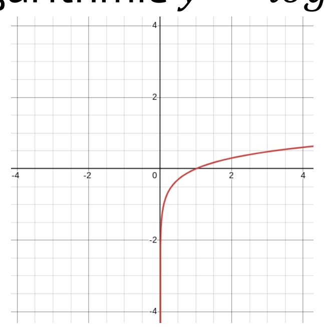
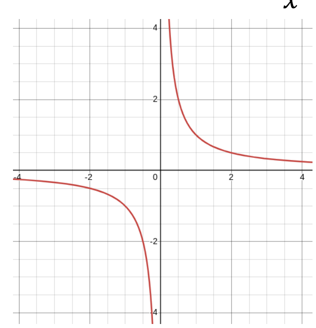
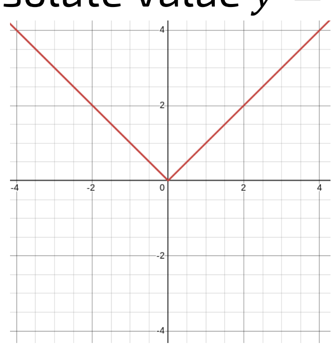
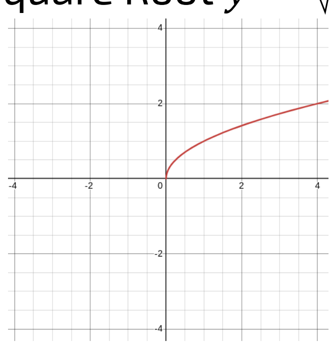
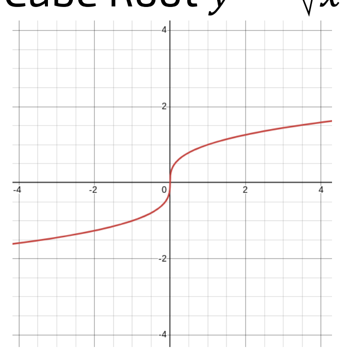
Functions:

Function converts inputs to outputs, where each input has one output

Examples: $f(x) = 2x$, $f(x) = x + 6$, $f(x) = x^2 + \frac{1}{x}$, $f(x) = 4$

Not functions: $x = 5$, $y = \pm x$ (Both have > 1 output for a single input)

Common Functions:

Linear $y = x$	Quadratic $y = x^2$	Cubic $y = x^3$
		
Exponential $y = 2^x$	Logarithmic $y = log(x)$	Rational $y = \frac{1}{x}$
		
Absolute Value $y = \lvert x \rvert$	Square Root $y = \sqrt{x}$	Cube Root $y = \sqrt[3]{x}$
		

Researched & Developed by: Pi-Rates Add to your knowledge

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Exponent Properties:

Property	Examples	
Product of Powers $a^n \bullet a^m = a^{n+m}$	$5^3 \bullet 5^4 = 5^{3+4} = 5^7$	$8^2 \bullet 8^8 = 8^{2+8} = 8^{10}$
Power of a Product $(a \bullet b)^n = a^n \bullet b^n$	$(4 \bullet 5)^6 = 4^6 \bullet 5^6$	$(11 \bullet 2)^3 = 11^4 \bullet 2^3$
Quotient of Powers $\frac{a^n}{a^m} = a^{n-m}$	$\frac{7^{24}}{7^9} = 7^{24-9} = 7^{15}$	$\frac{17^4}{17^2} = 17^{4-2} = 17^2$
Power of a Quotient $(\frac{a}{b})^n = \frac{a^n}{b^n}$	$(\frac{3}{4})^2 = \frac{3^2}{4^2}$	$(\frac{19}{7})^3 = \frac{19^3}{7^3}$
Power of a Power Property $(a^n)^m = a^{n \bullet m}$	$(8^4)^5 = 8^{4\bullet5} = 8^{20}$	$(4^3)^3 = 4^{3\bullet3} = 4^9$
Negative Exponent $a^{-n} = \frac{1}{a^n}$	$5^{-3} = \frac{1}{5^3}$	$6^{-2} = \frac{1}{6^2}$
Fractional Exponent $a^{\frac{n}{m}} = \sqrt[m]{a^n}$	$10^{\frac{2}{3}} = \sqrt[3]{10^2}$	$7^{\frac{3}{7}} = \sqrt[7]{7^3}$

Rates of Change:

Suppose we have a function $f(t) = 30t$, where $f(t)$ represents distance (in miles) traveled by a car and t represents time (in hours). How far does the car travel in 5 hours? How fast does the car travel?

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Hopefully you identified that the car traveled $30 \bullet 5 = 150$ miles in 5 hours and that the car traveled at a constant rate of 30 miles per hour. In this case $f(t) = 30t$ is our distance function. Since the car travels at a constant rate of 30 miles per hour, we can expressed it's a speed as the function $s(t) = 30$, which is our rate of change function.

Note the connection between the distance and rate functions. If you know how far the car traveled and how long it was traveling, you can figure out, on average, how fast it was traveling. Similarly, if you know how fast the car was traveling and how long it was driving for, you can figure out how far it went.

Algebraic Manipulation:

It is extremely important for you to know how to manipulate expressions and equations using algebra

Be familiar with the order of operations: PEMDAS - Parentheses, Exponents, Multiplication, Division, Addition, Subtraction

Here's how you would evaluate the following expression:

$$2 \bullet (6 \div 2 + 4)^2 = 2 \bullet (3 + 4)^2 = 2 \bullet 7^2 = 2 \bullet 49 = 98$$

There are several tools we can use to manipulate expressions without changing their value. Here are some of them:

- Multiplying by $\frac{x}{x} = 1$

Say we wanted to combine $\frac{1}{3x} + \frac{1}{6x}$ into one term. We can multiply the first term by $\frac{2}{2}$, which is the same as multiplying by 1 (so it does not change the value of the expression) to get a common denominator.

$$\frac{2}{2} \bullet \frac{1}{3x} + \frac{1}{6x} = \frac{2}{6x} + \frac{1}{6x} = \frac{3}{6x} = \frac{1}{2x}$$

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- Performing an operation to both sides of an equation

If $6 + 8 = 14$, then $\frac{6+8}{2} = \frac{14}{2}$

Likewise, If $3 \bullet 2 = 6$, then $2^{3\bullet2} = 2^6$

- Factor

Use the box-and-diamond method or grouping, or in some cases simply identify the common factor

$x^2 + 4x + 3 = (x + 3)(x + 1)$

$4x^3 - 11x^2 + x = x(4x^2 - 11x + 1)$

- Expand

Using FOIL, the box method, or the distributive property to expand an expression involving parenthesis

$(x - 4)(x + 3) = x^2 - 4x + 3x - 12 = x^2 - x - 12$

$x^2(4x - 9) = 4x^3 - 9x^2$

Common Mistakes

- $\frac{x+5}{x+3} \neq \frac{5}{3}$
- $2(x + 4) \neq 2x + 4$
- $(x + 3)^2 \neq x^2 + 3^2$
- $\frac{7}{0} \neq 0$
- $-5^2 \neq 25$
- $2(x + 3)^2 \neq (2x + 6)^2$

Equations of a Line:

There are three common ways of writing the equation of a line:

- Slope-Intercept Form: $y = mx + b$, where m is the slope of the line and b is the y-intercept
- Point-Slope Form: $y - y_1 = m(x - x_1)$, where m is the slope of the line and (x_1, y_1) is a point on the line
- Standard Form: $Ax + By = C$, where A, B, and C and integers

Know how to transform equations in one form to the others (you will likely use Slope-Intercept Form and Point-Slope Form the most)