

Summer Math Work: Calculus

We hope you are enjoying your summer but are also thinking about how to have a great school year next year.

The attached problem set is intended to address Pre-Calculus topics needed for success. **All calculus students are required to complete the problem set to be turned into their teacher as a homework assignment when returning to school in the fall.** This is the “summer reading” for your mathematics course. Be sure to show your work clearly in completing the problems.

If you find there are specific topics that you need to review in more depth, you may want to spend some time doing so. Please consider this in planning your time for work.

You are welcome to receive help on any of the problems or topics covered. Indeed, if you are having difficulty, we encourage you to work with a parent, older sibling, friend, or teacher so that you master each topic. You may consult a textbook or online resource if you wish as you work through these problems. **Be sure, however, to show all your work, and that you understand all the work you present. Note that you will have a graded classroom assessment on this material shortly after the start of school.**

We do not expect this packet to be a burden for you. However, we know that reviewing these topics will put you in a much better position to succeed in Calculus.

Best Wishes for a happy rest of the summer! ☺

1. Rational Expressions

Simplify the following expressions.

a. $\frac{x^3-8}{x-2}$

b. $\frac{5-x}{x^2-25}$

c. If $f(x) = x^3 - 4x$ and $g(x) = x^2 - x - 6$ which of the following is equivalent to $\frac{f(x)}{g(x)}$, for $x > 3$?

A. $\frac{1}{x-3}$

B. $\frac{x-2}{x-3}$

C. $\frac{x(x-2)}{x-3}$

D. $\frac{x(x+2)}{x-3}$

d. The equation $\frac{36x^2+17x-29}{kx-1} = -9x - 2 - \frac{31}{kx-1}$ is true for all values of $x \neq \frac{1}{k}$, where k is a constant. What is the value of k?

2. Linear Functions

a. Write the equation of a line that is parallel to $2x - 3y = 7$ and goes through the point (5, 1).

- b. A hair salon opened with 12 clients. The salon's growth plan assumes that 8 new clients will be gained each quarter (every 3 months) for the first two years. If an equation is written in the form $y = ax + b$ to represent the number of clients, y , served by the salon x quarters after the salon opened, what is the value of b ?

3. Function Operations

Use the following functions for the problems in this section:

$$f(x) = 7x - 8$$

$$g(x) = -9x^2 + 4$$

$$h(x) = x^2 + 1$$

a. Find $(f - g)(x)$

b. Find $(f + g + h)(x)$

c. Find $(gh)(x)$

4. Quadratic Functions

- a. If p is a solution to the equation below and $p > 0$, what is the value of p ?

$$x^2 + x - 20 = 0$$

- b. Which of the following is an equivalent form of $y = x^2 - 8x + 15$, from which the x-intercepts of the parabola can be identified as constants or coefficients? Select **and explain** your answer.

Option 1: $y - 15 = x^2 - 8x$

Option 2: $y + 1 = (x - 4)^2$

Option 3: $y = x(x - 8) + 15$

Option 4: $y = (x - 3)(x - 5)$

c. Factor the following polynomials completely.

$10x^2 + 21x + 9$	
$5x^2 + 7x - 6$	
$14x^2 + 63x - 35$	
$x^2 - 121$	
$2x^2 - 50$	
$8x^3 + 27$	

5. Expressions

a. Which of the following is equal to $x^{-\frac{1}{2}}$, for all values of x ? Select **and explain** your answer.

Option 1: \sqrt{x}

Option 2: $-\sqrt{x}$

Option 3: $\frac{1}{\sqrt{x}}$

Option 4: $-\frac{1}{x^2}$

b. For a positive real number, n , where $n^6 = 3$, what is the value of n^{18} ?

A. $\sqrt[3]{18}$

B. 2

C. 9

D. 27

c. Simplify completely using exponent rules:

$$\left(\frac{6x^{-3}z^3}{2xz^{-3}}\right)^{-3}$$

6. Trigonometry

a. Complete the trigonometric identities:

$$\sin^2 x + \cos^2 x =$$

$$1 + \tan^2 x =$$

$$\cot^2 x + 1 =$$

b. Simplify each expression.

$\frac{1}{x+h} - \frac{1}{x}$	$\log \frac{1}{100}$
$\ln e^7$	$27^{\frac{2}{3}}$
$\log_{\frac{1}{2}} 8$	$x^{\frac{3}{2}}(x + x^{\frac{5}{2}} - x^2)$

c. Without a calculator, determine the EXACT value of the expression.

$\sin \frac{\pi}{2} =$	$\sin \frac{3\pi}{4} =$	$\cos \pi =$	$\cos \frac{7\pi}{6} =$
$\cos \frac{\pi}{3} =$	$\tan \frac{7\pi}{4} =$	$\tan \frac{2\pi}{3} =$	$\tan \frac{\pi}{2} =$