

Incoming Precalculus Summer Work

Welcome! The Math Department is so excited that you are taking on the challenge of a course in Precalculus! Precalculus is an in-depth focus on functions and introduction to new families of functions, including trigonometric and exponential. In order to jump into new material as soon as possible, you will need to review topics in the following packet. Some of these concepts may be review to you, and some of them may be new. Do your best!

A few guidelines:

- On this assignment, you may use a calculator. That said, try as much as you can without one.
- If at any time, you need assistance with the topics included here, you may use online resources, such as Khan Academy. Any sources that you use should be cited.
- This assignment will be due on the first full day of school. There will be a non-calculator, graded assessment on these topics within the first two weeks of school.
- Below, you will find a suggested breakdown of the assignment into manageable pieces:
 - Week 1: June 19-June 23
 - Equations of Lines
 - Week 2: June 26-June 30
 - Exponents
 - Week 3: July 3-July 7
 - Polynomial Operations
 - Week 4: July 10-July 14
 - Factoring
 - Week 5: July 17-July 21
 - Radicals
 - Week 6: July 24-July 28
 - SAT Practice
- If you have any questions, you can reach me via email at mhain@stpaulsmd.org. Please note that it may take up to 48 hours to receive a response.

I'm looking forward to a great year ahead! Go gators!

-Mrs. Hain

Week 1: Equations of Lines

Slope Intercept form: $y = mx + b$

Vertical Line: $x = c$ (slope is undefined)

Point-slope form: $y - y_1 = m(x - x_1)$

Horizontal Line: $y = c$ (slope is 0)

Standard Form: $Ax + By = C$

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

1. State the slope and y-intercept of the linear equation $5x - 4y = 8$.
2. Find the x-intercept and y-intercept of the equation $2x - y = 5$.
3. Write the equation in standard form: $y = 7x - 5$.
4. Write the equation of the line in slope-intercept form with the following conditions: slope $= -5$, and passes through the point $(-3, -8)$.
5. Write the equation of the line in slope-intercept form with the following conditions: passes through the points $(4, 3)$ and $(7, -2)$.
6. Write the equation of the line in slope-intercept form with the following conditions: x-intercept $= 3$ and y-intercept $= 2$.

Week 2: Exponents

Two Rules of 1: <ul style="list-style-type: none">• $a^1 = a$ Any number raised to the power of one equals itself.• $1^a = 1$ One to any power is one.	Quotient Rule: <ul style="list-style-type: none">• $\frac{a^m}{a^n} = a^{m-n}$ When dividing two powers with the same base, subtract the exponents.
Zero Rule: <ul style="list-style-type: none">• $a^0 = 1$ Any nonzero number raised to the power of zero is one.	Power Rule: <ul style="list-style-type: none">• $(a^m)^n = a^{mn}$ When a power is raised to another power, multiply the exponents.
Product Rule: <ul style="list-style-type: none">• $a^m \cdot a^n = a^{m+n}$ When multiplying two powers that have the same base, add the exponents.	Negative Exponents: <ul style="list-style-type: none">• $a^{-n} = \frac{1}{a^n}$• $\frac{1}{a^{-n}} = a^n$ Any nonzero number raised to a negative power equals its reciprocal raised to the opposite positive power.

Express the following in simplest form. Answers should not have any negative exponents.

1. $5a^0$

3. $\frac{2ef^{-1}}{e^{-1}}$

2. $\frac{3c}{c^{-1}}$

4. $\frac{(n^3p^{-1})^2}{(np)^{-2}}$

Simplify the following.

5. $3m^2 \cdot 2m$

6. $(a^3)^2$

7. $(-b^3c^4)^5$

8. $4m(3a^2m)$

Week 3: Polynomial Operations

To add/subtract polynomials, combine like terms:

$$\begin{aligned} &8x - 3y + 6 - (6y + 4x - 9) \\ &= 8x - 3y + 6 - 6y - 4x + 9 \\ &= 4x - 9y + 15 \end{aligned}$$

To multiply polynomials, use FOIL or the distributive property.

$$\begin{aligned} &(3x - 2)(x + 4) \\ &= 3x^2 + 12x - 2x - 8 \\ &= 3x^2 + 10x - 8 \end{aligned}$$

1. Simplify the following:

a. $3x^3 + 9 + 7x^2 - x^3$

b. $7m - 6 - (2m + 5)$

2. Multiply the following:

a. $(3a + 1)(a - 2)$

b. $(c - 5)^2$

c. $(5x + 7y)(5x - 7y)$

Week 4: Factoring

To factor polynomials:

- Check for a GCF first
- With 3 terms, factor using either diamond method or slide/divide.
- With 2 terms, check if you can factor using difference of squares.

Factor the following expressions completely, using any method.

1. $b^2 - 19b + 90$

2. $6x^2 - 45x + 21$

3. $15r^2 + 21r + 6$

4. $-18k^2 + 15k + 168$

5. $4m^3 + 8m^2 + 7m + 14$

6. $4x^2 - 1$

7. $9r^2 - 25$

Week 5: Radicals

To **simplify** means that no radicand (inside number) has a perfect square factor and there is no radical in the denominator (rationalize).

Recall, the **product property**: $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$

And the **quotient property**: $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Examples:

Simplify $\sqrt{24} = \sqrt{6} \cdot \sqrt{4} = 2\sqrt{6}$

Rationalize $\frac{1}{\sqrt{2}}$

$$\begin{aligned}\frac{1}{\sqrt{2}} &\cdot \left(\frac{\sqrt{2}}{\sqrt{2}}\right) \\ &= \frac{\sqrt{2}}{\sqrt{4}} \\ &= \frac{\sqrt{2}}{2}\end{aligned}$$

Simplify or rationalize each of the following:

1. $\sqrt{32}$

2. $\sqrt{(2x)^8}$

3. $\sqrt{49m^2n^8}$

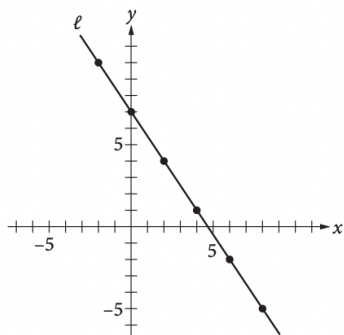
4. $(\sqrt{5} - \sqrt{6})(\sqrt{5} + \sqrt{2})$

5. $\frac{5}{\sqrt{3}}$

Week 6: SAT Practice

1

Line ℓ is graphed in the xy -plane below.



If line ℓ is translated up 5 units and right 7 units, then what is the slope of the new line?

- A) $\frac{2}{5}$
- B) $-\frac{3}{2}$
- C) $-\frac{8}{9}$
- D) $-\frac{11}{14}$

2

The average number of students per classroom, y , at Central High School can be estimated using the equation $y = 0.8636x + 27.227$, where x represents the number of years since 2004 and $x \leq 10$. Which of the following statements is the best interpretation of the number 0.8636 in the context of this problem?

- A) The estimated average number of students per classroom in 2004
- B) The estimated average number of students per classroom in 2014
- C) The estimated yearly decrease in the average number of students per classroom
- D) The estimated yearly increase in the average number of students per classroom

3

If $\frac{2}{a-1} = \frac{4}{y}$, and $y \neq 0$ where $a \neq 1$, what is y in terms of a ?

- A) $y = 2a - 2$
- B) $y = 2a - 4$
- C) $y = 2a - \frac{1}{2}$
- D) $y = \frac{1}{2}a + 1$

4

In the complex number system, which of the following is equal to $(14 - 2i)(7 + 12i)$? (Note: $i = \sqrt{-1}$)

- A) 74
- B) 122
- C) $74 + 154i$
- D) $122 + 154i$

5

The graph of $y = (2x - 4)(x - 4)$ is a parabola in the xy -plane. In which of the following equivalent equations do the x - and y -coordinates of the vertex of the parabola appear as constants or coefficients?

- A) $y = 2x^2 - 12x + 16$
- B) $y = 2x(x - 6) + 16$
- C) $y = 2(x - 3)^2 + (-2)$
- D) $y = (x - 2)(2x - 8)$

6

If $a^{-\frac{1}{2}} = x$, where $a > 0$ and $x > 0$, which of the following equations gives a in terms of x ?

- A) $a = \frac{1}{\sqrt{x}}$
- B) $a = \frac{1}{x^2}$
- C) $a = \sqrt{x}$
- D) $a = -x^2$

7

If $y = x^3 + 2x + 5$ and $z = x^2 + 7x + 1$, what is $2y + z$ in terms of x ?

- A) $3x^3 + 11x + 11$
- B) $2x^3 + x^2 + 9x + 6$
- C) $2x^3 + x^2 + 11x + 11$
- D) $2x^3 + 2x^2 + 18x + 12$

8

Which of the following is equal to $\sin\left(\frac{\pi}{5}\right)$?

- A) $-\cos\left(\frac{\pi}{5}\right)$
- B) $-\sin\left(\frac{\pi}{5}\right)$
- C) $\cos\left(\frac{3\pi}{10}\right)$
- D) $\sin\left(\frac{7\pi}{10}\right)$