

AP Precalculus Summer Prep Packet

Students entering AP Precalculus must have a strong foundation in algebra as well as some trigonometry. Most questions in this packet concern skills and concepts that will be used extensively in this course. Others have not been included so much because they are skills that are used frequently, but because being able to answer them indicates a strong grasp of important mathematical concepts and—more importantly—the ability to problem-solve.

This course is going to be very fast and will involve students to be able to calculate most of their calculations without a calculator. **Students should complete most of this packet without a calculator.** But calculators will still be used throughout this course. If you have not already done so, please consider picking up a TI-84 Graphing Calculator.

This course requires students to represent problems in multiple ways (numerically, algebraically, graphically), and to justify answers using clear, logical analysis. This is not a course where every problem given on a test or quiz is identical to problem types done repeatedly during class. Tests and quizzes—as well as the AP exam—require students to apply skills and concepts to seemingly new situations and/or to connect multiple mathematical ideas.

You need to show ALL work with logical steps. DO NOT list only an answer. Round all answers to 3 decimal places when necessary. Work neatly and in an organized fashion. Please expect a quiz within the first few days of the school year over this material. You may ask questions over the packet and any other pre-requisite information when we return in August. We will begin new material on the 2nd day of school, so it is imperative that these skills are mastered in order to be successful moving forward in the course.

You got this! 😊

-Ms. Chung

PART I: LINEAR FUNCTIONS

Write the standard form equation of the line through the given points.

1. (0, 2) and (-4, 4)

2. (0,1) and (-1, -3)

Write the slope-intercept form equation of the line described below .

3. through: (4,1), parallel to $y = -\frac{1}{4}x + 4$

Write the standard form equation of the line described below.

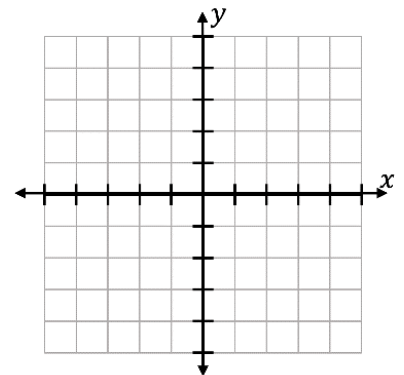
4. through: (1, -4), perpendicular to $y = \frac{1}{8}x + 4$

Write the point-slope form equation of the line through the given points.

5. (0, 4) and (-3, 3)

Find the x- and y- intercepts. Then use them to graph the line on the provided grid.

6. $7x - 3y = 6$

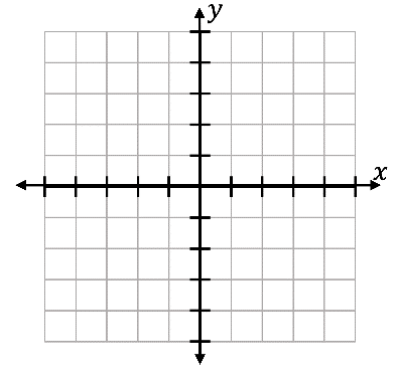


Graph the following lines on the provided grid.

7. $x = -3$

8. $y = 4$

9. $y = 3x$



Write an equation to model the given situation. Define all variables. Determine the slope and its meaning. Determine the y-intercept and its meaning. Sketch the graph with clearly labeled axes.

11. Jimmy runs a company that is unfortunately laying off workers because of the economy. At the beginning of the year, the company has 90 employees, but with consistent layoffs, there are 78 employees left 4 months later. Write an equation to model the number of employees at Jimmy's company at a particular time.

NOTE: USE DECIMALS IF NECESSARY; ROUND THEM TO NEAREST HUNDREDTH.

a. Variables:

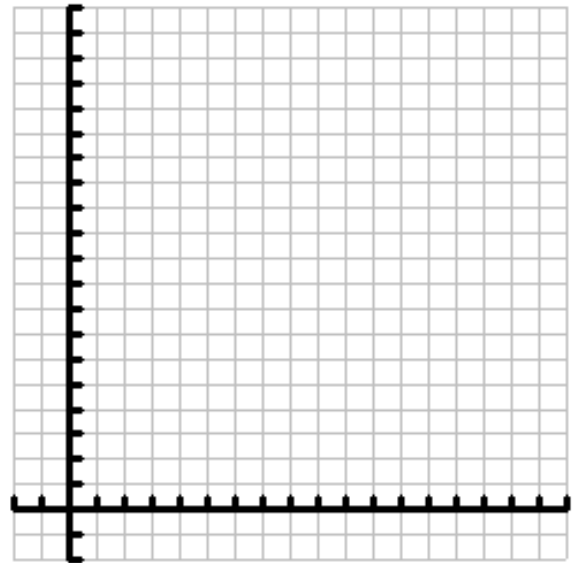
b. Equation:

c. Slope:

Meaning:

d. Y-intercept:

Meaning:



PART II: SOLVING EQUATIONS AND INEQUALITIES

Solve each equation or inequality.

1. $5(m + 5) + 3 = 3(2m + 5)$

2. $-\frac{77}{12} + \frac{7}{2}a = -\frac{1}{2}\left(\frac{10}{3}a + \frac{7}{6}\right) + \frac{5}{8}$

3. $\frac{37}{8}\left(\frac{3}{2}n + \frac{1}{3}\right) = -\frac{77}{96} + \frac{9}{4}n$

4. $-8(1 + m) - 6m \geq -106$

5. $1 \leq 7 + 2n < 15$

6. $-\frac{401}{20} - 8r < \frac{11}{8}\left(\frac{11}{2}r - 1\right)$

PART III: POLYNOMIALS: ADDITION, SUBTRACTION, AND MULTIPLICATION

Simplify the following expressions.

1. $(14x^4 - 3x^2 + 2) + (3x^3 + 4x^2 + 5)$

2. $(5 - x^4 - 2x^3) - (-6x^2 + 5x + 5)$

3. $(8m^2 - 1)(3m^2 - 4m + 5)$

4. $(4x - 3y)^2$

Divide the expressions using long division.

5. $(2x^3 - 7x^2 - 22x + 20) \div (2x + 5)$

6. $(4x^4 + 3x^3 + 2x + 1) \div (x^2 + x + 2)$

Divide the expressions using synthetic division.

7. $(3x^3 + 5x^2 + 15) \div (x - 8)$

8. $(3x^3 - 6x + 7) \div (x - 2)$

PART IV: FACTORING QUADRATIC TRINOMIALS

Factor each expression completely.

1. $3x^2 - 108$

2. $3x^2 + 24x$

3. $4x^2 - 8x + 4$

4. $-5x^2 + 51x - 54$

5. $15x^3 - 70x^2 - 120x$

6. $-9x^3 + 18x^2 + 15x - 30$

7. $-12x^3 - 18x^2$

8. $x^3y^6 - 64$

PART V: SOLVING QUADRATIC EQUATIONS AND INEQUALITIES

Find the roots of each equation using the quadratic formula.

1. $3x^2 - 5 = 2x$

2. $10x^2 = -9$

Solve the following quadratic word problems ALGEBRAICALLY.

3. A garden measuring 12 meters by 16 meters is to have a pedestrian pathway installed all around it, increasing the total area to 285 square meters. What will be the width of the pathway?

5. An object is launched straight up into the air with an initial velocity of 64 ft/sec. It is launched from a height of 6 feet off the ground. Its height H , in feet, at t seconds is given by the equation $H = -16t^2 + 64t + 6$. Find all times t that the object is at height of 54 feet off the ground.

7. The base of a triangle is 1 centimeter shorter than the altitude. If the area is 15 cm², what is the length of the altitude?

Solve each equation using factoring.

8. $7x^2 - 3 = -4x$

9. $4x^2 - 13x - 31 = 4$

$$10. -10 = -13x - 5x^2 - 4$$

$$11. 16x^3 - 12x^2 - 40x = 0$$

Solve the following quadratic inequalities ALGEBRICALLY. State the solution set in interval notation. Draw a number line and shade it accordingly. If required, state the solution in DECIMAL FORM, 3 DECIMAL PLACES.

$$12. 0 < -2x^2 + 7x - 5$$

$$13. 0 \leq x^2 - 4x + 4$$

PART VI: QUADRATIC FUNCTIONS

Write the quadratic equation in vertex form given the following information.

1. Vertex at (-2, 10) & passes through (-6, -12)

2. Minimum at (-1, -10) & y-intercept at (0, -9)

Write the following equations in vertex form by completing the square. Then state the vertex and whether it is a minimum or maximum.

$$3. x^2 + 5x + 18 = 0$$

$$4. x^2 - x = -7$$

$$5. 5x^2 - 20x - 11 = 0$$

$$6. -4x^2 - 56x + 19 = 10$$

Determine the type of model that best fits the data (quadratic, linear or exponential) and calculate the average rate of change of the function on the given interval.

7. Interval: $[-2, 1]$

x	$f(x)$
-2	1/4
-1	1/2
0	1
1	2
2	4

8. $(-3, -2), (-2, -3), (-1, -1), (0, 4), (1, 12)$ Interval: $[-3, 0]$

Find the average rate of change of the given function on the given interval.

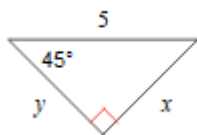
9. $f(x) = -2(x + 5)^2 + 3$

Interval: $[-2, 5]$

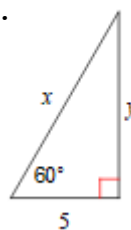
PART VII: RIGHT TRIANGLE TRIGONOMETRY

Find the value of all variables below using special right triangle ratios. Do not leave radicals in the denominators of your fractions.

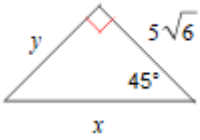
1.



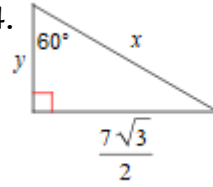
2.



3.



4.



Use a trigonometric ratio to solve the following problems.

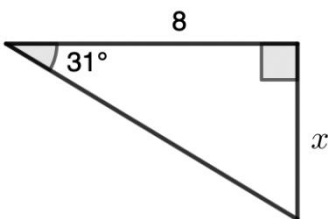
5. An ant is looking up at you with an angle of elevation of 48° . You are 6 feet tall. How far is the ant from your foot? Round to 3 decimal places.

6. A baseball diamond is in the shape of a square with each side being 90 feet. If the catcher throws out a runner at second base who was trying to steal, how far does he need to throw the ball?

7. The shorter leg of a $30^\circ - 60^\circ - 90^\circ$ triangle is 7.4 meters long. Find the perimeter.

8. Find the altitude of an equilateral triangle if each side of the triangle has a length of 14 meters.

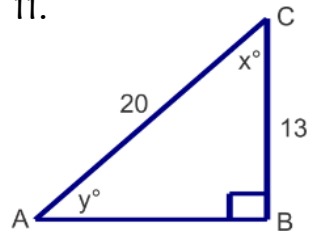
9. Solve for x .



Find the value of the missing angle.

10. If $\sin \theta = \frac{3}{7}$, find θ .

11.



PART VIII: SOLVING SYSTEMS OF EQUATIONS

Solve the system of equations algebraically.

1. $25x - 5y = 30$
 $-35x + 7y = -7$

2. $8x - y + 3z = -38$
 $2x + 5y - 4z = 32$
 $x - y + z = -9$

3. $5x - 2y = 14$
 $-3x + y = -7$

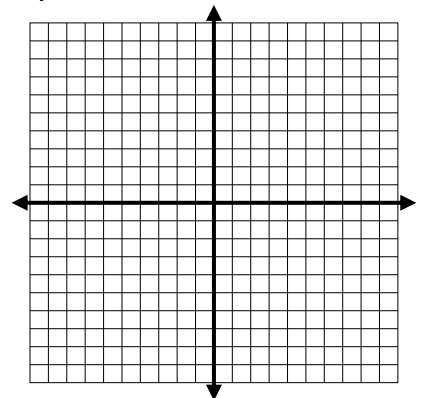
4. $-4x - 2y - z = 5$
 $2x - z = 8$
 $y - 2z = -4$

PART IX: PIECEWISE FUNCTIONS

Graph the following functions. Then write the absolute value function as a piecewise function.

1. $f(x) = |x^2 - 1|$

Piecewise function:



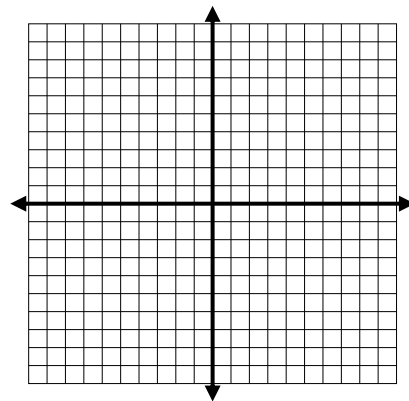
Graph the following functions. Then evaluate them at requested values.

$$2. h(x) = \begin{cases} -e^x + 7, & -\infty < x < 0 \\ 3, & 0 < x < 3 \\ |2x + 2|, & 3 \leq x < 4 \end{cases}$$

a. $h(-10) =$

b. $h(0) =$

c. $h(2) =$



PART X: EXPONENTIAL FUNCTIONS

1. The population of a species of ant grows at a rate of 13% every six months. If there are initially 85 ants in the colony, how many would be present after 3.5 years?

2. The half-life of a radioactive isotope is 10 years. Initially, there are 500 grams of the isotope in the laboratory. How much of the isotope would remain after 33 years?

3. The value of a car depreciates by 17% a year. If a car is initially purchased for \$28,000, what would be the worth of the car after 5 years?

4. Andi invests \$7,500 in a savings account that pays 2.55% interest compounded monthly. How much money will be in the account after 20 years?

PART XI: RULES OF EXPONENTS

Use properties of exponents to simplify the expressions completely.

1. $b^4 \cdot b^2$

2. $x^{-3} \cdot x^5$

3. $(5y)^2$

4. $\left(\frac{x}{x^2y}\right)^2$

5. $\left(\frac{n}{4m^2n}\right)^{-2}$

6. $\frac{2^{-4}2^2}{(2^2)^{-4}}$

7. $\frac{(2(2^2)^{-3})^2}{2^{-5}}$

8. $\frac{(-x^{-1}y^2)^{-1}}{x^{-2}y^3(x^0y^{-2})^3}$

PART XII: SIMPLIFYING RADICALS

Simplify the following expressions as much as possible.

1. $\sqrt{75x^7y^5}$

2. $\sqrt{27a^{11}b^7}$

3. $\frac{4}{\sqrt{8}}$

4. $-\frac{4}{3\sqrt{2}}$

5. $4\sqrt{5} + \sqrt{125} + \sqrt{45}$

6. $\sqrt{48} + 10 - \sqrt{100} - \sqrt{98}$

$$7. 2x\sqrt{3x^2} + 5 - 7\sqrt{3x^2} - 2$$

$$8. 3x\sqrt{18} - 3\sqrt{98x^2} + 2x\sqrt{12x^2}$$

PART XIII: COMPLEX NUMBERS

Simplify the following expressions as much as possible.

$$1. (3i^{31} - 3)(4 + i^{57})$$

$$2. (i\sqrt{2} - 6) - (3i\sqrt{32} + 15) + (-2i\sqrt{18} - 11)$$

$$3. i\sqrt{3}(-2 - i\sqrt{6})$$

$$4. \frac{3-4i}{3i}$$