

# AP Pre-Calculus Summer Assignment

June 2024

Dear Student:

This assignment is a mandatory part of the AP Pre-Calculus course. Students who do not complete the assignment will be placed in the regular level Pre-Calculus course at the beginning of the 2024-2025 school year.

Work should be done neatly and completely with all work shown and all answers clearly indicated. You may work with another student or students, and you may e-mail us for help. However, any evidence of copying will result in failure of the assignment and may constitute grounds for removal from the class. The important thing is that YOU understand the work.

The assignment is worth 25 points. You **may** have a test on the summer assignment material within the two weeks of school.

You will need a graphing calculator for part of this assignment. I recommend the TI-84 or TI-84+. The TI-nSpire is ok, but we will be using the 84 in class, so if you do not own a graphing calculator, you should buy a TI-84 this summer.

If you need help, please do not hesitate to email us. Our email addresses are [tbelgrod@springfieldschools.com](mailto:tbelgrod@springfieldschools.com) and [knewman@springfieldschools.com](mailto:knewman@springfieldschools.com). We do not necessarily check email every day and may be on vacation for part of the summer. Please, do not wait until the last minute to email us if you are having trouble.

Due Date: The assignment is due to **your** teacher on the first day of school! No excuses!

If you want, you may scan your assignment, convert it to a .pdf file, and e-mail it to both of us.

The assignment is broken up into several topics which appear on the following pages.

You must show all work to receive credit.

**AP Pre Calculus Summer Assignment – Mandatory**

Name \_\_\_\_\_

- This assignment is due the first day of school.
  - There may be an assessment based upon this assignment at the beginning of the year.
  - The following are prerequisite topics and skills for Precalculus. Students should have proficiency in these topics.
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**Part 1:** Proficiency with the skills and concepts related to linear and quadratic functions, including algebraic manipulation, solving equations, and solving inequalities.

*Directions: Solve for the variable.*

1)  $2x = 23 - 2x$

2)  $\frac{x}{2} = 3(2x - 15)$

3)  $2x + 5 = 3(2x - 4)$

4)  $-3 = \frac{60}{2 - x}$

5)  $\frac{x + 2}{6} + \frac{x + 4}{8} = 9$

6)  $\frac{7}{2x - 1} = \frac{5}{3}$

$$7) \quad \frac{x+3}{5} < 2$$

$$8) \quad \frac{2x-3}{4} + 9 \geq 3 + \frac{4x}{3}$$

$$9) \quad \frac{9}{5}(x-2) < 5(2-x)$$

$$10) \quad 2x + \frac{3}{2} < -15 + x$$

$$11) \quad 2x + 4 < 5x - 6$$

$$12) \quad \frac{x-8}{x+5} + 4 \geq 3$$

**Part 2:** Proficiency in manipulating algebraic expressions related to polynomial functions, including polynomial addition and multiplication, factoring quadratic trinomials, and using the quadratic formula.

**Directions:** Solve for the variable.

13)  $3x^2 - 4x + 4 = 0$

14)  $(3x - 4)^2 = 16$

15)  $5x^2 = 2x - 3$

16)  $(3x + 1)(x - 5) = 0$

17)  $x(2x - 5) = 12$

18)  $-x^2 + 3x + 19 = 11x + 17$

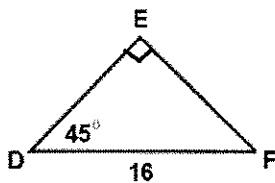
19)  $3x^2 + 10x - 10 = -3x$

20)  $5x^2 - 4x + 2 - 2x - 4x^2 = 0$

**Part 3: Proficiency in solving right triangle problems involving trigonometry.**

**Directions: Solve the right triangle.**

21)

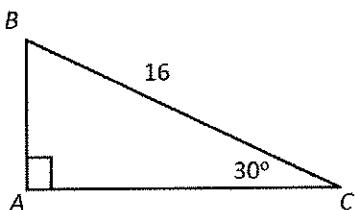


$ED =$

$EF =$

$m\angle F =$

22)

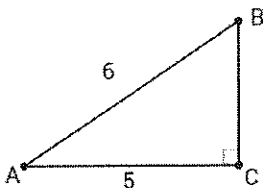


$AB =$

$AC =$

$m\angle B =$

23)

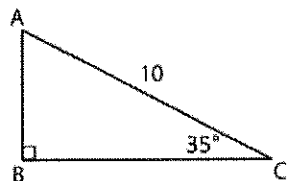


$BC =$

$m\angle A =$

$m\angle B =$

24)



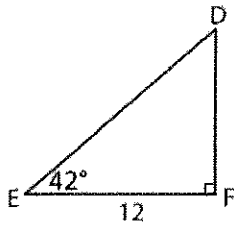
$AB =$

$BC =$

$m\angle A =$

$m\angle B =$

25)



$$ED =$$

$$DF =$$

$$m\angle D =$$

**Directions: Solve for the unknown.**

- 26) From the top of a lighthouse 37 meters high, a boat is sighted having an angle of depression of 4 degrees. How far from the lighthouse is the boat?
- 27) A hot air balloon, which is at a perpendicular height of 43 meters, is anchored by a rope which has an angle of elevation of 59 degrees. Find the length of the rope.

**Part 4: Proficiency in solving systems of equations in two and three variables.**

**Directions: Solve for the unknown variables.**

28)  $x + y = 4$   
 $2x - 3y = 18$

29)  $-6x + 4y = -28$   
 $6x + 7y = 11$

30)  $2x - y + z = 3$   
 $x + y = -1$   
 $3x - y - 2z = 7$

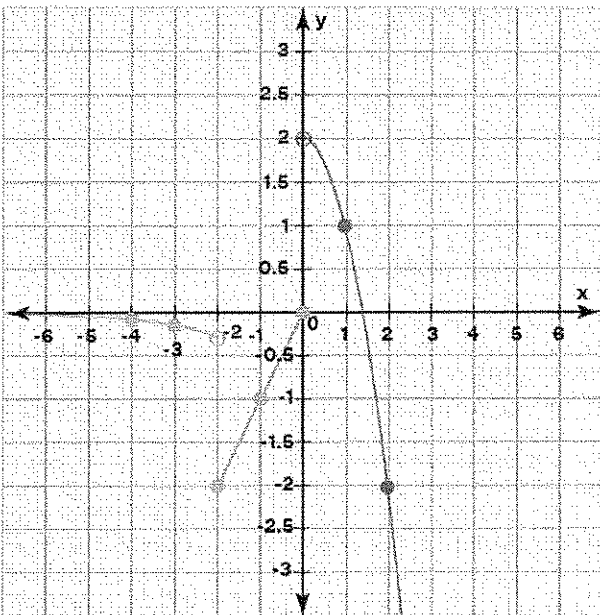
31)  $2x + 4y + 2z = 16$   
 $-2x - 3y + z = -5$   
 $2x + 2y - 3z = -3$

32)  $36 = -18y - 22x$   
 $-16 + 20x - 8y = 0$

33)  $-\frac{5}{7} + y = \frac{11}{7}x$   
 $2y = 7 + 5x$

**Part 5: Familiarity with piecewise-defined functions.**

**Directions:** Use the graph to answer the following questions.



34) Domain:

35) Range:

36)  $f(-1) =$

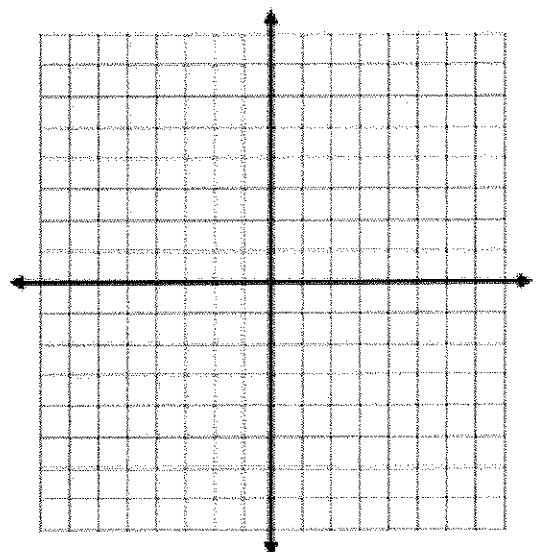
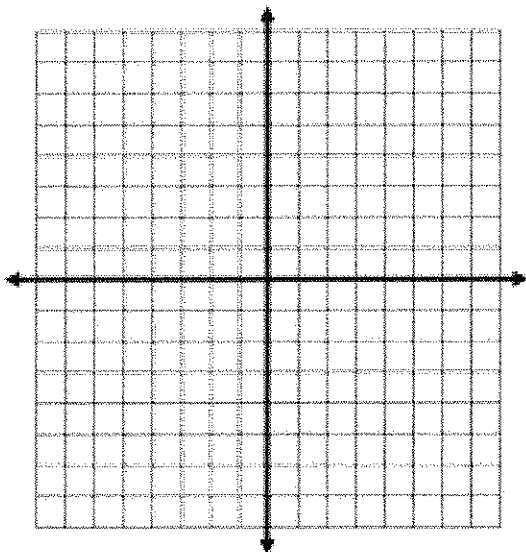
37)  $f(2) =$

38)  $f(x) = -2$

**Directions:** Graph the following piecewise functions.

39)  $f(x) = \begin{cases} x - 2, & x < -2 \\ -4, & x \geq -2 \end{cases}$

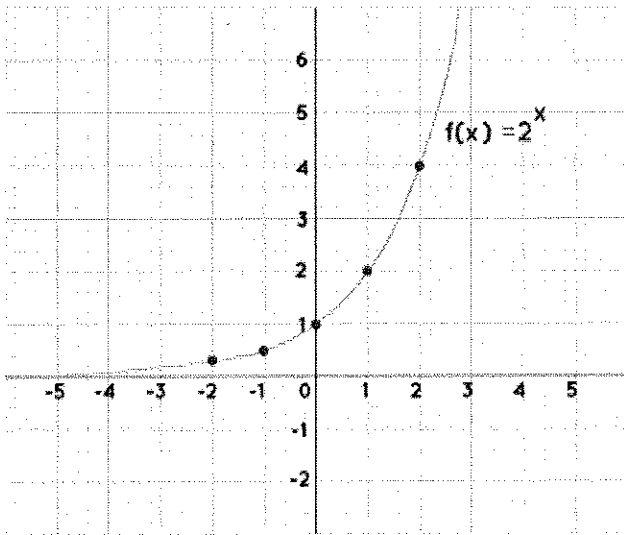
40)  $f(x) = \begin{cases} x^2, & x \leq 0 \\ -2x + 4, & x > 0 \end{cases}$





**Part 6: Familiarity with exponential functions and rules for exponents**

**Directions:** Use the graph to answer the following questions.



41) Domain:

42) Range:

43)  $f(2) =$

44) Does the function have a horizontal or vertical asymptote?

45) Write the equation of the asymptote

**Directions:** Determine how the function changes when compared to the parent function.

46)  $f(x) = 3^x - 7$

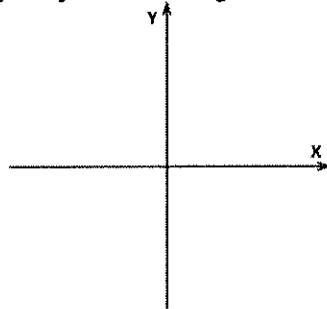
47)  $f(x) = \left(\frac{1}{2}\right)^{x+5}$

48)  $f(x) = 4(2)^x$

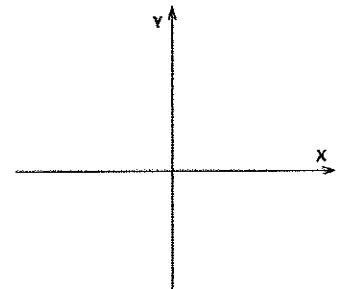
49)  $f(x) = -4^x$

**Directions:** Determine if the function is a growth or decay function. Make a sketch.

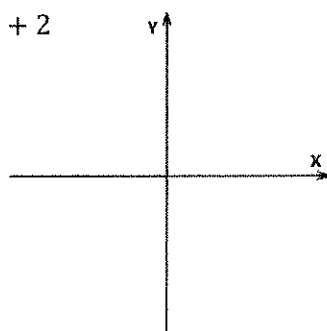
50)  $f(x) = 5^x - 2$



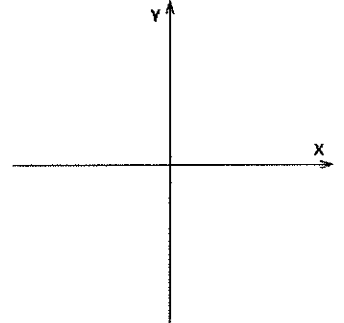
51)  $f(x) = 3^{-x}$



52)  $f(x) = 3\left(\frac{1}{4}\right)^x + 2$



53)  $f(x) = -(2)^x$



**Directions: Evaluate each expression without a calculator using the rules of exponents.**

54)  $3^2 \cdot 3$

55)  $3 \cdot 3^3$

56)  $\frac{5^5}{5^2}$

57)  $(3^3)^0$

58)  $-3^2$

59)  $(2^3 \cdot 3^2)^2$

60)  $\left(-\frac{3}{5}\right)^3 \left(\frac{5}{3}\right)^2$

61)  $\frac{3 \cdot 4^{-4}}{3^{-4} \cdot 4^{-1}}$

62)  $32(-2)^{-5}$

63)  $(-2)^0$

64)  $2^{-1} + 3^{-1}$

65)  $(2^{-1})^{-2}$

**Directions: Simplify each expression without using a calculator.**

66)  $(-5z)^3$

67)  $(3x)^2$

68)  $6y^2(2y^0)^2$

69)  $(-z)^3(3z^4)$

70)  $\frac{7x^2}{x^3}$

71)  $\frac{x^4}{x^6}$

72)  $5x^4(x^2)$

73)  $(4x^3)^0$

74)  $\frac{25y^8}{10y^4}$

**Directions:** Perform the operations and simplify.

$$75) \frac{(2x^2)^{\frac{3}{2}}}{2^{\frac{1}{2}}x^4}$$

$$76) \frac{x^{\frac{4}{3}}y^{\frac{2}{3}}}{(xy)^{\frac{1}{3}}}$$

$$77) \frac{x^{-3} \cdot x^{\frac{1}{2}}}{x^{\frac{3}{2}} \cdot x^{-1}}$$

$$78) \frac{5^{-\frac{1}{2}} \cdot 5x^{\frac{5}{2}}}{(5x)^{\frac{3}{2}}}$$

**Part 7: Familiarity with radicals (e.g. square roots, cube roots)**

**Directions:** Simplify each radical expression.

$$79) \sqrt{8}$$

$$80) \sqrt[3]{54}$$

$$81) \sqrt[3]{\frac{16}{27}}$$

$$82) \sqrt{72x^3}$$

$$83) \sqrt{\frac{75}{4}}$$

$$84) \sqrt[3]{-32x^6y^4}$$

$$85) \sqrt{\frac{18^2}{z^3}}$$

$$86) \sqrt{54xy^4}$$

$$87) \sqrt{\frac{32a^4}{b^2}}$$

$$88) \sqrt[3]{16x^5}$$

$$89) \sqrt{75x^2y^{-4}}$$

$$90) \sqrt[4]{3x^4y^2}$$

91)  $\sqrt[5]{160x^8z^4}$

92)  $2\sqrt{50} + 12\sqrt{8}$

93)  $10\sqrt{32} - 6\sqrt{18}$

**Directions: Evaluate each expression without using a calculator.**

94)  $\sqrt{9}$

95)  $\sqrt[3]{\frac{27}{8}}$

96)  $27^{\frac{1}{3}}$

97)  $36^{\frac{3}{2}}$

98)  $32^{-\frac{3}{5}}$

99)  $\left(\frac{16}{81}\right)^{-\frac{3}{4}}$

100)  $100^{-\frac{3}{2}}$

101)  $\left(\frac{9}{4}\right)^{-\frac{1}{2}}$

102)  $\left(-\frac{1}{64}\right)^{\frac{1}{3}}$

103)  $\left(\frac{1}{\sqrt{32}}\right)^{-\frac{2}{5}}$

104)  $\left(-\frac{125}{27}\right)^{-\frac{1}{3}}$

105)  $-\left(\frac{1}{125}\right)^{-\frac{4}{3}}$

**Directions: Rationalize the denominator of the expression. Then simplify your answer.**

106)  $\frac{1}{\sqrt{3}}$

107)  $\frac{5}{\sqrt{10}}$

108)  $\frac{2}{5 - \sqrt{3}}$

**Part 8: Familiarity with complex numbers**

Directions: Simplify each expression.

109)  $\sqrt{-90}$

110)  $i^{115}$

111)  $-5 - \sqrt{-36}$

112)  $(-8 + 7i) - (5 + 4i)$

113)  $(4i) + (-11 + 2i) - (-3i)$

114)  $(-1 + 3i)(1 + 9i)$

**Part 9: Familiarity with communicating and reasoning among graphical, numerical, analytical, and verbal representations of functions.**

115) The quadratic functions  $f(x)$  and  $q(x)$  are given below.

$$f(x) = x^2 + 2x - 8$$

$x$	-4	-3	-2	-1	0	1
$q(x)$	-12	-15	-16	-15	-12	7

Which function has the smaller minimum value?

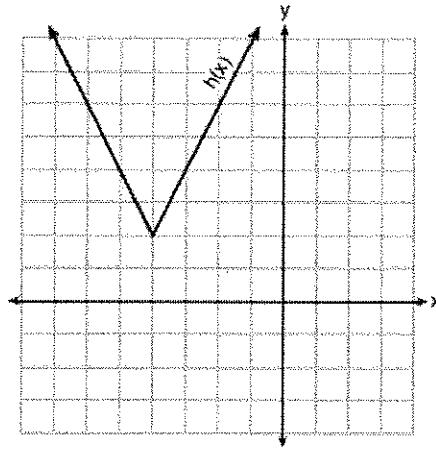
116) The quadratic functions  $g(x)$  and  $h(x)$  are given below.

$$g(x) = (x - 3)^2 + 2$$

$x$	0	1	2	3	4	5	6
$h(x)$	4	-1	-4	-5	-4	-1	4

Compare and contrast the vertex for the functions.

- 117) The function  $h(x)$  is graphed below, and the function  $g(x) = 2|x + 4| - 3$  is given.



Determine which statement(s) about these functions are true

- A.  $g(x)$  has a lower minimum value than  $h(x)$
  - B. For all values of  $x$ ,  $h(x) < g(x)$
  - C. For any value of  $x$ ,  $g(x) \neq h(x)$
- 118) Determine which function has the greatest y-intercept.
- A.  $f(x) = 3x$
  - B. A line that has a slope of 2 and passes through  $(1, -4)$
  - C.  $2x + 3y = 12$
  - D.

