

# PreCalc Honors Summer Preparation

Please follow the below instructions to join **BOTH** Algebra 2 and PreCalc to use as resources while completing the summer work.

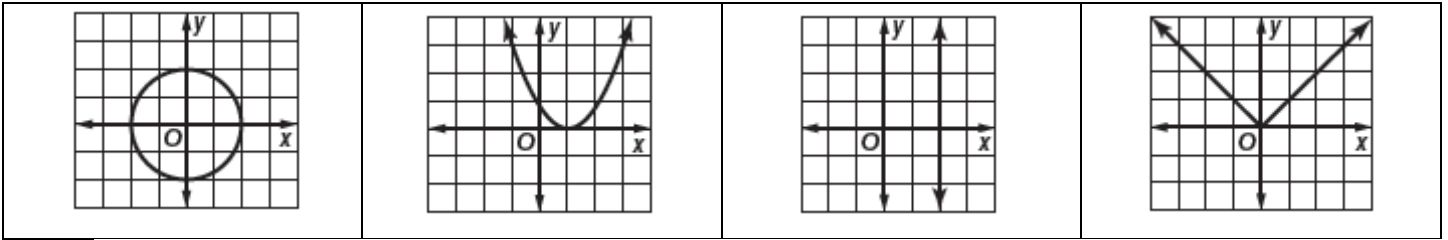


## How to join your teacher's Khan Academy class

- 1 Sign up at [khanacademy.org](https://khanacademy.org) (or log in if you already have an account).
- 2 Visit [khanacademy.org/coaches](https://khanacademy.org/coaches) (the "Coaches" tab in your profile).
- 3 In the "Join a class" field, enter the class code.  
  
Class code: Algebra 2 6487HJQ2  
PreCalc 7V9C8P
- 4 You're set. Now click [Home](#) to start learning!

Chapter 1

1. Determine whether each relation is a function. Explain why or why not.



2. Find the zeros and intercepts of  $f(x) = -\frac{2}{3}x - 8$

3. Find  $f(-9)$  for  $f(x) = \begin{cases} -3|x+5| & \text{if } x < 1 \\ -9 & \text{if } x \geq 1 \end{cases}$

4. Given  $g(x) = -2\sqrt{x^2}$ , find  $g(8+x)$ .

Name \_\_\_\_\_

Show all work. Circle your answers.

5. To what is the graph of an odd function symmetric? Explain.

**A** the  $x$ -axis

**B** the  $y$ -axis

**C** the line  $y = x$

**D** the origin

6. Which function has an infinite discontinuity? How do you know?

$f(x) = \begin{cases} 2 & \text{if } x > 0 \\ 3 & \text{if } x \geq 0 \end{cases}$	$f(x) = \frac{x^2 - 49}{x - 7}$	$f(x) = \frac{1}{2x - 9}$	$f(x) = x^5 - x^3$
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7. Simon will make a box without a top by cutting out corners of equal size from a 22 inch by 15 inch sheet of cardboard and folding up the sides. What is the maximum volume of the box?

8. Describe the characteristics of  $f(x) = |x|$ . State the domain, range, intercepts, symmetry, continuity, end behavior, intervals that are increasing-decreasing-constant, and extrema.

Name \_\_\_\_\_

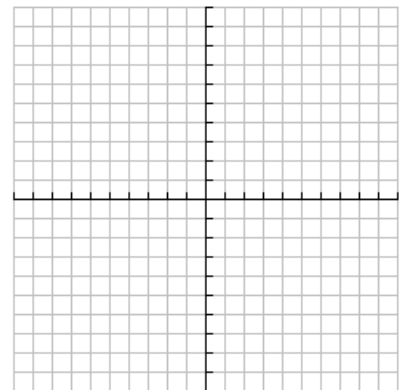
Show all work. Circle your answers.

9. Which of the following results in the graph of  $f(x) = \sqrt{x}$  being compressed horizontally by a factor of 2, expanded vertically and reflected in the y-axis?

a. $f(x) = -2\sqrt{3x}$	b. $f(x) = -3\sqrt{2x}$	c. $f(x) = 2\sqrt{-3x}$	d. $f(x) = 3\sqrt{-2x}$
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10. Describe the transformations relating the graph of  $g(x) = \frac{1}{2}(x - 3)^2$  to the graph of its parent function  $f(x) = x^2$ .

11. Graph the piece-wise function:  $f(x) = \begin{cases} 4 & \text{if } x < 5 \\ x^3 & \text{if } -2 \leq x \leq 2 \\ \sqrt{x+3} & \text{if } x > 3 \end{cases}$

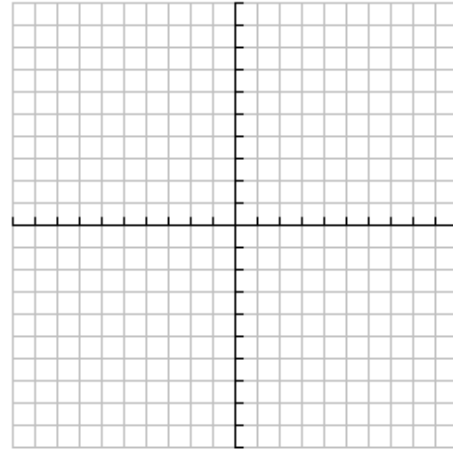


12. If  $f(x) = \frac{x}{x-3}$  and  $g(x) = 2x - 1$ , find  $(f + g)(x)$ ,  $(f - g)(x)$ ,  $(f \cdot g)(x)$ ,  $(f/g)(x)$ . State the domain for each.

Name \_\_\_\_\_

Show all work. Circle your answers.

13. Find the inverse of  $f(x) = 2\sqrt{x} + 3$ . State any domain restrictions. Sketch  $f$  and  $f^{-1}$  on the same coordinate plane.



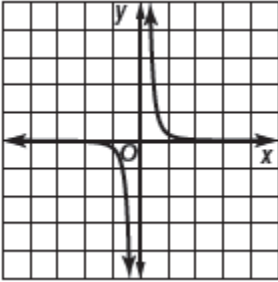
14. Which function is a one-to-one function? Explain.

a. $f(x) = 3 x  - 4$	b. $f(x) = -3\sqrt{x+5}$	c. $f(x) = \frac{2x-2}{x^2}$	d. $f(x) = x^3 - 8x$
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15.  $f(x) = x^2 + 1$  and  $g(x) = \frac{1}{x}$ , find  $(f \circ g)(x)$  and  $(g \circ f)(x)$ .

Chapter 2

1. The graph of  $f(x) = \frac{1}{4}x^{-3}$  is shown at the right. Analyze the function (domain, range, continuity, intervals that are increasing/decreasing/constant, symmetry, extrema, asymptotes, and end behavior)



2. Which is *not* a power function? Why?

a. $f(x) = 3x^5$	b. $f(x) = \frac{3}{x}$	c. $f(x) = x^{\frac{1}{3}}$	d. $f(x) = 3^x$
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3. Solve  $\sqrt{6x-2} = \sqrt{4x+4}$ .

4. Solve  $\sqrt[3]{10x+2} - 3 = -5$ .

Name \_\_\_\_\_

Show all work. Circle your answers.

5. What is the greatest possible number of real zeros of  $f(x) = x^3 - 2x^2 - x + 1$ ?
  
  
  
  
  
  
  
  
  
  
6. Divide  $(x^3 + 5x^2 + 5x - 2)$  by  $(x + 2)$  using long division.
  
  
  
  
  
  
  
  
  
  
7. The height  $h$  in feet of a ball thrown into the air after  $t$  seconds is given by  $h(t) = -16t^2 + 35t + 6$ . Use synthetic substitution to find the height of the ball after 0.5 second.
  
  
  
  
  
  
  
  
  
  
8. Find the remainder when  $2x^3 + 6x^2 + 3x - 1$  is divided by  $x - 1$ . Is the binomial a factor of the polynomial?

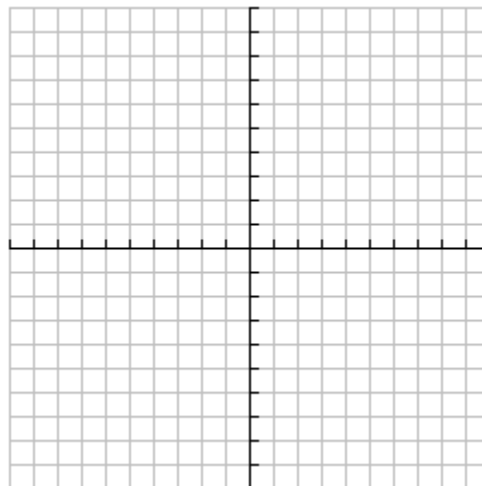
Name \_\_\_\_\_

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9. Find all the possible rational zeros of  $f(x) = 4x^3 + 5x^2 - x + 2$ ?

10. Write the linear factorization of  $x^4 - 6x^3 + 54x - 81$

11. Determine the asymptotes and intercepts of  $f(x) = \frac{x^2 - 4}{x^3 - 5x^2 + 6x}$ . Sketch the graph.

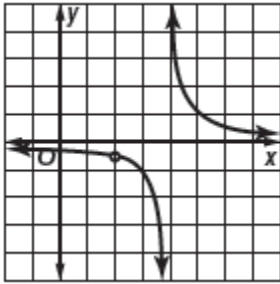




Name \_\_\_\_\_

Show all work. Circle your answers.

12. Which of the following could be the function represented by the graph?



a. $f(x) = \frac{1}{x-4}$	b. $f(x) = \frac{x+2}{x-4}$	c. $f(x) = \frac{x-2}{(x-2)(x-4)}$	d. $f(x) = \frac{x-2}{(x-2)(x+4)}$
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13. Solve  $5x^3 - 7x^2 - 19x - 15 = 0$

14. Solve  $\frac{1}{x+4} = \frac{1}{x^2 + 3x - 4} + \frac{4}{x-1}$ .

Name \_\_\_\_\_

Show all work. Circle your answers.

15. Which of the following is the solution to  $(x + 3)(x - 2) \leq 0$ ?

a. $(-\infty, \infty)$	b. $(-\infty, 3)$ or $(2, \infty)$	c. $(-2, 3)$	d. $[-3, 2]$
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16. Solve  $\frac{6}{q} + 4 \geq \frac{3}{q}$ .

17. Solve  $\frac{14}{x^2 - 3x} - \frac{8}{x} < \frac{-10}{x - 3}$

18. Find the polynomial function of least degree with real coefficients in standard form that has the zeros  $-1$ ,  $3$ , and  $\pm 3i$ .

Name \_\_\_\_\_

Show all work. Circle your answers.

19. **TEMPERATURE** The low temperature for a city every other day is shown. Which function best models the data?

<b>x</b>	0	2	4	6	8	10	12	14	16	18	20
<b>f(x)</b>	2	5	5	4	2	0	-2	-2	0	5	14

- a.  $f(x) = 0.2x^3 - 0.4x^2 + 2.2x + 2$   
b.  $f(x) = 2x^3 - 40x^2 + 217x + 199$   
c.  $f(x) = 0.02x^3 - 0.4x^2 + 2.17x + 1.99$   
d.  $f(x) = 0.02x^3 - 4x^2 + 2.17x - 1.99$

20. The elevation above ground for a rider on the Big Monster roller coaster is given in the table.

<b>Time (seconds)</b>	5	10	15	20	25
<b>Elevation (feet)</b>	85	62	22	4	17

- a. Determine a polynomial function to represent the data.
- b. Use the model to estimate a rider's elevation at 17 seconds.
- c. Use the model to determine approximately the first time a rider is 50 feet above the ground.

Name \_\_\_\_\_

Show all work. Circle your answers.

### Chapter 3

1. In 2008, the bird population in a certain area was 10,000. The number of birds increases exponentially at a rate of 9% per year. Predict the population in 2013.

a. 15,386	b. 15,683	c. 15,489	d. 15,771
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2. A scientist has 86 grams of a radioactive substance that has a half life of 12 hours. How many grams of radioactive substance remain after 5 days?

3. Determine a formula for the exponential function

x	f(x)
-2	144
-1	72
0	36
1	18
2	9

4. Write  $3^{-2} = \frac{1}{9}$  in logarithmic form.

a. $\log_3(-2) = \frac{1}{9}$	b. $\log_3 \frac{1}{9} = -2$	c. $\log_{-2} \frac{1}{9} = 3$	d. $\log_{-2} 3 = \frac{1}{9}$
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5. Evaluate  $\log_9 \frac{1}{27}$ .

Name \_\_\_\_\_

Show all work. Circle your answers.

6. Solve  $\log_4 x + \log_4 (x - 2) = \log_4 15$ .

7. Find the value of  $\log_6 27.5$ .

a. 0.661	b. 1.439	c. 1.850	d. 2.232
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8. Solve  $5^x = 3^{x+2}$

9. Solve  $e^{0.2x} = 21.2$ .

Name \_\_\_\_\_

Show all work. Circle your answers.

10. Solve  $8e^{2x} + e^x + 9 = 3 + 15e^x$

11. Condense  $3\log x + \log 7 - 2\log y$ .

a. $\log \frac{7x^3}{y^2}$	b. $\log \frac{21x}{2y}$	c. $\log \frac{21x}{y^2}$	d. $\log 7x^3y^2$
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12. Expand  $\ln \frac{5x^6}{11y^7}$ .

a. $6\ln 5x - 7\ln 11y$	b. $\ln 6 + \ln 5x - \ln 7 - \ln 11y$	c. $\ln 5 + 6\ln x - \ln 11 - 7\ln y$	d. $6\ln 5x + 7\ln 11y$
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13. Express  $\log \frac{125}{81}$  in terms of  $\log 3$  and  $\log 5$

Name \_\_\_\_\_

Show all work. Circle your answers.

14. Solve  $\ln x + \ln (x - 4) = \ln 12$ .

15. Find the amount of time required for an investment to double at a rate of 12.3% if the interest is compounded continuously.

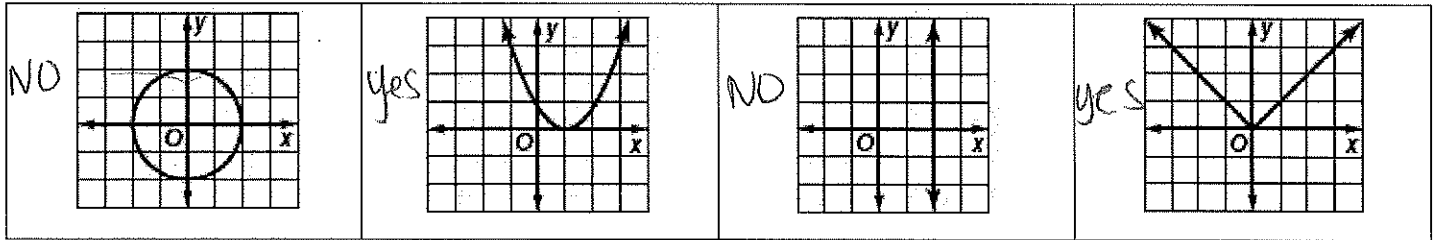
16. The number of students infected with the flu on a college campus after  $t$  days is modeled by the function

$$P(t) = \frac{320}{1 + 39e^{-0.3t}}$$

What was the initial number of infected students? What is the maximum number of students that can be infected with the flu?

Chapter 1

1. Determine whether each relation is a function. Explain why or why not.



2. Find the zeros and intercepts of
- $f(x) = -\frac{2}{3}x - 8$

$(0, -8)$

$(-12, 0)$

3. Find
- $f(-9)$
- for
- $f(x) = \begin{cases} -3|x+5| & \text{if } x < 1 \\ -9 & \text{if } x \geq 1 \end{cases}$

$-12$

4. Given
- $g(x) = -2\sqrt{x^2}$
- , find
- $g(8+x)$
- .

$-2|8+x|$



Name \_\_\_\_\_

Show all work. Circle your answers.

5. To what is the graph of an odd function symmetric? Explain.

A the x-axis

B the y-axis

C the line  $y = x$

D the origin

6. Which function has an infinite discontinuity? How do you know?

$f(x) = \begin{cases} 2 & \text{if } x > 0 \\ 3 & \text{if } x \geq 0 \end{cases}$	$f(x) = \frac{x^2 - 49}{x - 7}$	$f(x) = \frac{1}{2x - 9}$	$f(x) = x^5 - x^3$
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7. Simon will make a box without a top by cutting out corners of equal size from a 22 inch by 15 inch sheet of cardboard and folding up the sides. What is the maximum volume of the box?  $432.23 \text{ in}^3$

8. Describe the characteristics of  $f(x) = |x|$ . State the domain, range, intercepts, symmetry, continuity, end behavior, intervals that are increasing-decreasing-constant, and extrema. *+ asymptotes*

1.  $D = (-\infty, \infty)$

2.  $R = [0, \infty)$

3.  $(0, 0)$

4. even

5. continuous

6.  $\lim_{x \rightarrow -\infty} = \infty$   $\lim_{x \rightarrow \infty} = \infty$

7. inc:  $(0, \infty)$

dec:  $(-\infty, 0)$

con: none

⑧ min at  $(0, 0)$

⑨ no asymptotes

Name \_\_\_\_\_

Show all work. Circle your answers.

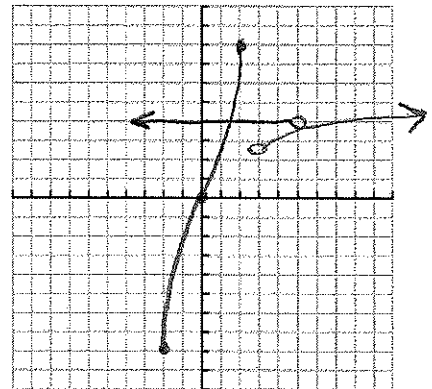
9. Which of the following results in the graph of  $f(x) = \sqrt{x}$  being compressed horizontally by a factor of 2, expanded vertically and reflected in the  $y$ -axis?

a. $f(x) = -2\sqrt{3x}$	b. $f(x) = -3\sqrt{2x}$	c. $f(x) = 2\sqrt{-3x}$	d. $f(x) = 3\sqrt{-2x}$
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10. Describe the transformations relating the graph of  $g(x) = \frac{1}{2}(x - 3)^2$  to the graph of its parent function  $f(x) = x^2$ .

Shift right 3  
v. stretch by factor of 3

11. Graph the piece-wise function:  $f(x) = \begin{cases} 4 & \text{if } x < 5 \\ x^3 & \text{if } -2 \leq x \leq 2 \\ \sqrt{x+3} & \text{if } x > 3 \end{cases}$



12. If  $f(x) = \frac{x}{x-3}$  and  $g(x) = 2x-1$ , find  $(f+g)(x)$ ,  $(f-g)(x)$ ,  $(f \cdot g)(x)$ ,  $(f/g)(x)$ . State the domain for each.

a.  $\frac{x}{x-3} + 2x-1$   $D = (-\infty, 3) \cup (3, \infty)$

c.  $\frac{x(2x-1)}{x-3}$   $D = (-\infty, 3) \cup (3, \infty)$

b.  $\frac{x}{x-3} - (2x-1)$   $D = (-\infty, 3) \cup (3, \infty)$

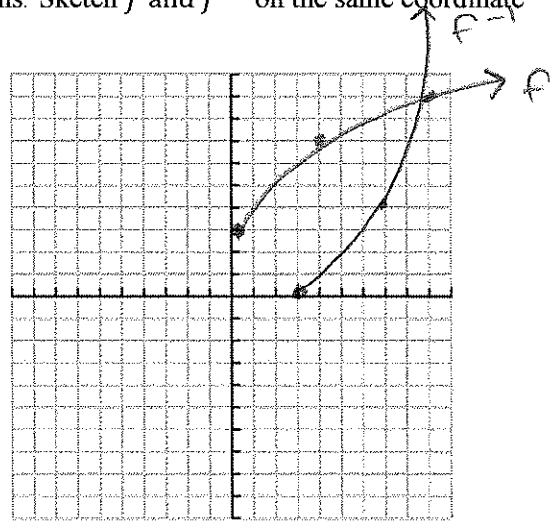
d.  $\frac{x}{(x-3)(2x-1)}$   $D = (-\infty, 1/2) \cup (1/2, 3) \cup (3, \infty)$

Name \_\_\_\_\_

Show all work. Circle your answers.

13. Find the inverse of  $f(x) = 2\sqrt{x} + 3$ . State any domain restrictions. Sketch  $f$  and  $f^{-1}$  on the same coordinate plane.

$D = [3, \infty)$   
 $R = [0, \infty)$



14. Which function is a one-to-one function? Explain.

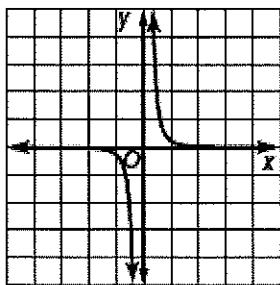
a. $f(x) = 3 x  - 4$	<span style="border: 1px solid black; border-radius: 50%; padding: 2px;">b.</span> $f(x) = -3\sqrt{x+5}$	c. $f(x) = \frac{2x-2}{x^2}$	d. $f(x) = x^3 - 8x$
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15.  $f(x) = x^2 + 1$  and  $g(x) = \frac{1}{x}$ , find  $(f \circ g)(x)$  and  $(g \circ f)(x)$ .

$\frac{1}{x^2} + 1$                        $\frac{1}{x^2 + 1}$

## Chapter 2

1. The graph of  $f(x) = \frac{1}{4}x^{-3}$  is shown at the right. Analyze the function (domain, range, continuity, intervals that are increasing/decreasing/constant, symmetry, extrema, asymptotes, and end behavior) + intercepts



1.  $D = (-\infty, 0) \cup (0, \infty)$

2.  $R = (-\infty, 0) \cup (0, \infty)$

3. infinite discontinuity at  $x=0$  (v.a)

4. inc: none

dec:  $(-\infty, 0) \cup (0, \infty)$ 

dec: none

5. odd

6. no extrema

7. v.a.  $x=0$

h.a.  $y=0$

8.  $\lim_{x \rightarrow \infty} = 0$

$x \rightarrow \infty$

$\lim_{x \rightarrow -\infty} = 0$

$x \rightarrow -\infty$

9. no intercepts

2. Which is *not* a power function? Why?

a.  $f(x) = 3x^5$

b.  $f(x) = \frac{3}{x}$

c.  $f(x) = x^{\frac{1}{3}}$

d.  $f(x) = 3^x$

3. Solve  $\sqrt{6x-2} = \sqrt{4x+4}$ .

3

4. Solve  $\sqrt[3]{10x+2} - 3 = -5$ . -1

Name \_\_\_\_\_

Show all work. Circle your answers.

5. What is the greatest possible number of real zeros of  $f(x) = x^3 - 2x^2 - x + 1$ ?

3

6. Divide  $(x^3 + 5x^2 + 5x - 2)$  by  $(x + 2)$  using long division.

$$x^2 + 3x - 1$$

7. The height  $h$  in feet of a ball thrown into the air after  $t$  seconds is given by  $h(t) = -16t^2 + 35t + 6$ . Use synthetic substitution to find the height of the ball after 0.5 second.

19.5 ft.

8. Find the remainder when  $2x^3 + 6x^2 + 3x - 1$  is divided by  $x - 1$ . Is the binomial a factor of the polynomial?

10, no

Name \_\_\_\_\_

Show all work. Circle your answers.

9. Find all the possible rational zeros of  $f(x) = 4x^3 + 5x^2 - x + 2$ ?

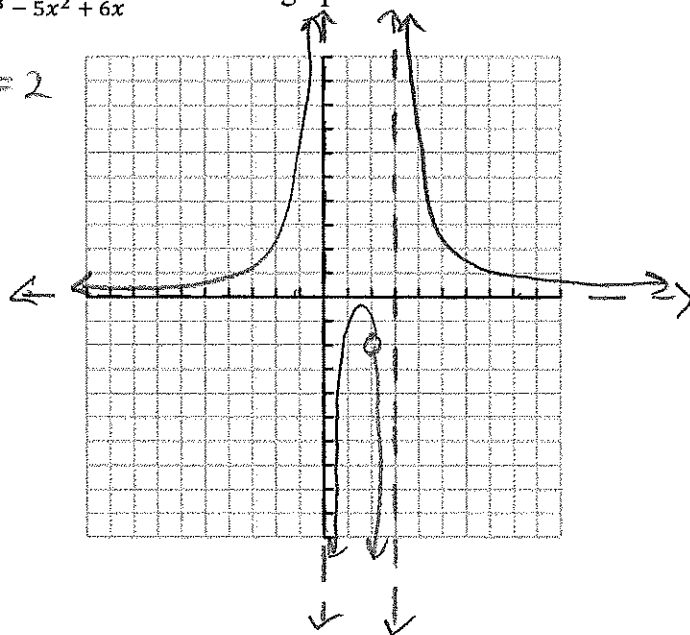
$$\pm 1, \pm 2, \pm \frac{1}{2}, \pm \frac{1}{4}$$

10. Write the linear factorization of  $x^4 - 6x^3 + 54x - 81$

$$(x - 3)^3(x + 3)$$

11. Determine the asymptotes and intercepts of  $f(x) = \frac{x^2 - 4}{x^3 - 5x^2 + 6x}$ . Sketch the graph.

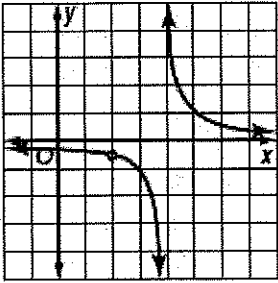
V. a.  $x = 0, x = 3$ , hole at  $x = 2$   
h. a.  $y = 0$



Name \_\_\_\_\_

Show all work. Circle your answers.

12. Which of the following could be the function represented by the graph?



- |                           |                             |                                    |                                    |
|---------------------------|-----------------------------|------------------------------------|------------------------------------|
| a. $f(x) = \frac{1}{x-4}$ | b. $f(x) = \frac{x+2}{x-4}$ | c. $f(x) = \frac{x-2}{(x-2)(x-4)}$ | d. $f(x) = \frac{x-2}{(x-2)(x+4)}$ |
|---------------------------|-----------------------------|------------------------------------|------------------------------------|

13. Solve  $5x^3 - 7x^2 - 19x - 15 = 0$      3

14. Solve  $\frac{1}{x+4} = \frac{1}{x^2+3x-4} + \frac{4}{x-1}$      -6

Name \_\_\_\_\_

Show all work. Circle your answers.

15. Which of the following is the solution to  $(x+3)(x-2) \leq 0$ ?

a. $(-\infty, \infty)$	b. $(-\infty, 3)$ or $(2, \infty)$	c. $(-2, 3)$	d. $[-3, 2]$
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16. Solve  $\frac{6}{q} + 4 \geq \frac{3}{q}$ .  $(-\infty, -3/4] \cup [0, \infty)$

17. Solve  $\frac{14}{x^2-3x} - \frac{8}{x} < \frac{-10}{x-3}$   
 $(-\infty, -19) \cup (0, 3)$

18. Find the polynomial function of least degree with real coefficients in standard form that has the zeros  $-1, 3,$  and  $\pm 3i$ .

$$x^4 - 2x^3 + 6x^2 - 18x - 27$$



19. **TEMPERATURE** The low temperature for a city every other day is shown. Which function best models the data?

<b>x</b>	0	2	4	6	8	10	12	14	16	18	20
<b>f(x)</b>	2	5	5	4	2	0	-2	-2	0	5	14

- a.  $f(x) = 0.2x^3 - 0.4x^2 + 2.2x + 2$   
 b.  $f(x) = 2x^3 - 40x^2 + 217x + 199$   
 c.  $f(x) = 0.02x^3 - 0.4x^2 + 2.17x + 1.99$   
 d.  $f(x) = 0.02x^3 - 4x^2 + 2.17x - 1.99$

20. The elevation above ground for a rider on the Big Monster roller coaster is given in the table.

<b>Time (seconds)</b>	5	10	15	20	25
<b>Elevation (feet)</b>	85	62	22	4	17

- a. Determine a polynomial function to represent the data.

$$y = -0.002x^4 + 0.152x^3 - 3.65x^2 + 27.3x + 22$$

- b. Use the model to estimate a rider's elevation at 17 seconds.

$$10.98 \text{ ft}$$

- c. Use the model to determine approximately the first time a rider is 50 feet above the ground.

$$11.43 \text{ sec}$$

Name \_\_\_\_\_

Show all work. Circle your answers.

Chapter 3

1. In 2008, the bird population in a certain area was 10,000. The number of birds increases exponentially at a rate of 9% per year. Predict the population in 2013.

a. 15,386	b. 15,683	c. 15,489	d. 15,771
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2. A scientist has 86 grams of a radioactive substance that has a half life of 12 hours. How many grams of radioactive substance remain after 5 days?

.084g

3. Determine a formula for the exponential function

$$y = 36 \left(\frac{1}{2}\right)^x$$

x	f(x)
-2	144
-1	72
0	36
1	18
2	9

4. Write  $3^{-2} = \frac{1}{9}$  in logarithmic form.

a. $\log_3(-2) = \frac{1}{9}$	b. $\log_3 \frac{1}{9} = -2$	c. $\log_{-2} \frac{1}{9} = 3$	d. $\log_{-2} 3 = \frac{1}{9}$
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5. Evaluate  $\log_9 \frac{1}{27}$ . - 3/2

Name \_\_\_\_\_

Show all work. Circle your answers.

6. Solve  $\log_4 x + \log_4 (x - 2) = \log_4 15$ . 5

7. Find the value of  $\log_6 27.5$ .

a. 0.661	b. 1.439	<span style="border: 1px solid black; border-radius: 50%; padding: 2px;">c.</span> 1.850	d. 2.232
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8. Solve  $5^x = 3^{x+2}$

4, 3

9. Solve  $e^{0.2x} = 21.2$ .

15, 27

Name \_\_\_\_\_

Show all work. Circle your answers.

10. Solve  $8e^{2x} + e^x + 9 = 3 + 15e^x$

$0, -29$

11. Condense  $3\log x + \log 7 - 2\log y$ .

<input checked="" type="radio"/> a. $\log \frac{7x^3}{y^2}$	b. $\log \frac{21x}{2y}$	c. $\log \frac{21x}{y^2}$	d. $\log 7x^3y^2$
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12. Expand  $\ln \frac{5x^6}{11y^7}$ .

a. $6\ln 5x - 7\ln 11y$	b. $\ln 6 + \ln 5x - \ln 7 - \ln 11y$	<input checked="" type="radio"/> c. $\ln 5 + 6\ln x - \ln 11 - 7\ln y$	d. $6\ln 5x + 7\ln 11y$
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13. Express  $\log \frac{125}{81}$  in terms of  $\log 3$  and  $\log 5$

$3\log 5 - 4\log 3$

Name \_\_\_\_\_

Show all work. Circle your answers.

14. Solve  $\ln x + \ln(x - 4) = \ln 12$ .

6

15. Find the amount of time required for an investment to double at a rate of 12.3% if the interest is compounded continuously.

5.64 yrs

16. The number of students infected with the flu on a college campus after  $t$  days is modeled by the function

$$P(t) = \frac{320}{1 + 39e^{-0.3t}}$$

What was the initial number of infected students? What is the maximum number of students that can be infected with the flu?

8 students, 320 students