

# Unit 1 Prerequisite Topics

Homework will be assigned daily. Be prepared for potential HW pop quizzes every day by doing homework nightly.

Topics Covered:

- ❖ Factoring Polynomials
- ❖ Rates of Change & Linear Equations
- ❖ Functions & Their Graphs (Domain, Piecewise Functions, Compositions, & Transformations)
- ❖ Exponential & Logarithmic Functions
- ❖ The Unit Circle & Evaluating Trig Functions

Quiz is \_\_\_\_\_

Test is \_\_\_\_\_

Name: \_\_\_\_\_

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# Factoring

## Factoring Trinomials

1.  $x^2 + 6x + 8$

2.  $x^2 - x - 6$

3.  $c^2 + 5c + 6$

4.  $y^2 + 3y - 18$

5.  $3y^2 + 14y - 49$

6.  $3b^2 + 21b - 54$

7.  $6x^2 - 42x + 72$

8.  $7a^2 - 38a - 24$

9.  $15a^2 + 4a - 4$

10.  $8c^2 = 30 + 43c$

11.  $x^6 - 14x^3 + 24$

12.  $15x^3 + 20x^2 - 25x$

## Factoring by GCF

13.  $5c^3 - 2c^2$

14.  $81r + 48rs$

15.  $15cd + 30c^2d^2$

16.  $a^2b^2 + a$

## Factoring Special Binomials

17.  $5a^2 - 20$

18.  $y^3 - 1$

19.  $8x^3 + 64$

20.  $1 - 49c^2$

21.  $-27 + p^3$

22.  $200r^2 - 18$

23.  $36 - n^4$

24.  $16 - 81f^8$

## Factoring by Grouping

25.  $6mn - 9m - 4n + 6$

26.  $2x^2y + 6xy - x - 3$

27.  $6x^3 - 3x^2 + 8x - 4$

28.  $4r^3 - 8r^2 - 3r + 6$

# Average Rate of Change

Use the table of values to find the average rate of change over the given interval.

$x$	1	2	3	3.5	3.7	6
$y$	40	25	18	15	18	38

1.  $[1,3]$

2.  $[2,6]$

3.  $[2,3.7]$

4.  $[3.5,6]$

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

5.  $f(x) = x^2 - 4x - 12$  on  $[0,6]$

6.  $f(x) = x^2 - 4x - 12$  on  $[-1,7]$

7.  $f(x) = 3x^2 - x - 2$  on  $[-1,4]$

8.  $f(x) = 0.02x^2 - 1.6x + 20.5$  on  $[25,33]$

9.  $f(x) = 3x^5 - 4x^4 + 3x^2 - 4x + 1$  on  $[-6,1]$

10.  $f(x) = \frac{x^2-6}{x+3}$  on  $[-5, -2]$

# Equations of Lines

1. Write the slope-intercept form of the equation:

$$11x - 8y = -48$$

2. Write the point-slope form of the equation of the line through the given point with the given slope:

$$(3,5), m = \frac{5}{3}$$

3. Write the point-slope form of the line through the point  $(4,2)$  & parallel to  $y = -5x + 2$

4. Write the point-slope form of the line through the point  $(-2,4)$  & perpendicular to

$$y = -\frac{5}{2}x + 5$$

5. Write the slope-intercept form of the equation:

$$-4x - 7y + 3 = -48$$

6. Write the slope-intercept form of the equation of the line through the given point with the given slope:

$$(1, -3), m = -\frac{2}{3}$$

7. Write the point-slope form of the equation of the line through  $(5, -3)$ , parallel to  $4y = -3x + 6$ .

8. Write the slope-intercept form of the equation of the line through the point  $(5,7)$  & slope of  $-2$ .

# Piecewise Functions

Evaluate for the following piecewise functions:

1.  $f(x) = \begin{cases} x^2 + 2, & x \leq 1 \\ 2x^2 + 2, & x > 1 \end{cases}$

a.  $f(-2)$

b.  $f(0)$

c.  $f(1)$

d.  $f(s^2 + 2)$

2.  $f(x) = \begin{cases} 1, & x < 0 \\ \sqrt{x}, & x \geq 0 \end{cases}$

a.  $f(-2)$

b.  $f(0)$

c.  $f(1)$

d.  $f(s^2)$

3.  $f(x) = \begin{cases} x + 2, & -2 \leq x \leq -1 \\ 1 - \sqrt{1 - x^2}, & -1 < x < 1 \\ -x + 2, & 1 \leq x \leq 2 \end{cases}$

a.  $f(-1.5)$

b.  $f(0)$

c.  $f(3)$

d.  $f(1.5)$

4.  $f(x) = \begin{cases} 4 - x^2, & x < 1 \\ \frac{3}{2}x + \frac{3}{2}, & 1 \leq x \leq 3 \\ -x + 2, & x > 3 \end{cases}$

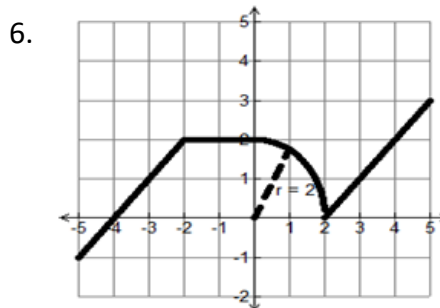
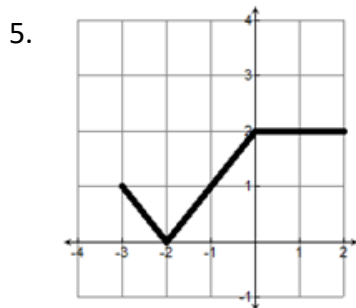
a.  $f(5)$

b.  $f(0)$

c.  $f(3)$

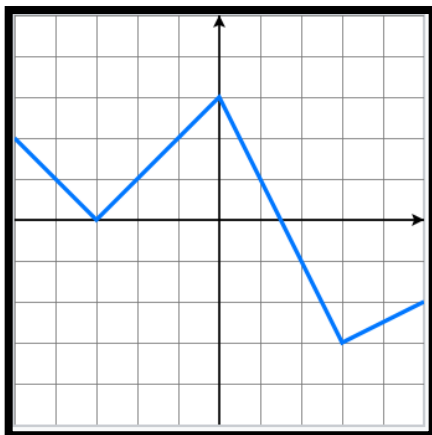
d.  $f(2)$

Find the formula for the following:



# Transformations

Draw a graph of each transformation. Let  $f(x)$  be the function below. Label the critical points. Finally write a description of the transformation.

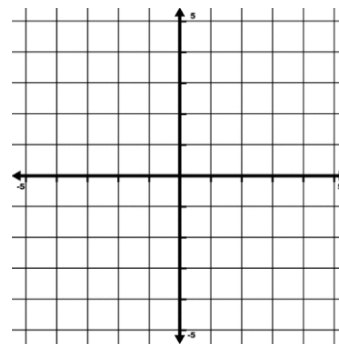
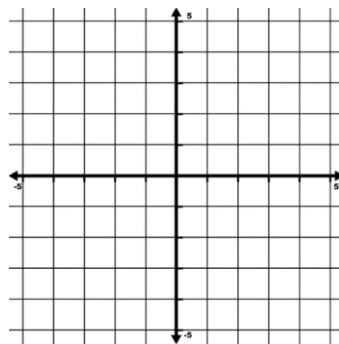
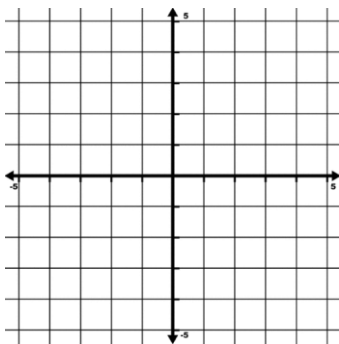
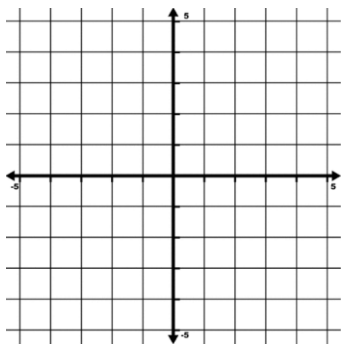


1.  $f(2x)$

2.  $2f(x)$

3.  $f(x + 2)$

4.  $f(x) - 2$



Describe the transformations from the parent graph for the following functions:

5.  $g(x) = \frac{1}{2}x^3 - 5$

6.  $g(x) = \sqrt{x - 7} + 4.8$

7.  $g(h) = -5(h + 1)$

8.  $j(k) = \frac{5}{3}|k| - 10$

9.  $g(x) = 3e^{x-3} - 5$

10.  $m(x) = \frac{-1}{x+7} + 6$

# Domain

State the domain of the following. Show your work.

1.  $f(x) = \frac{3x-5}{x+1}$

2.  $f(x) = \sqrt{\frac{3x-5}{x+1}}$

3.  $f(x) = \ln(x - 7)$

4.  $f(x) = \ln\left(\frac{x}{x-1}\right)$

5.  $f(x) = \sqrt[3]{3x + 2}$

6.  $f(x) = \frac{x+1}{x^2+5x+4}$

7.  $f(x) = \ln\left(\frac{x+1}{x-3}\right)$

8.  $f(x) = \sqrt[4]{x^2 - 8x - 33}$

9.  $f(x) = \frac{x}{x^2-9}$

10.  $f(x) = \frac{1}{\sqrt{x-2}}$

$$11. f(x) = \sqrt{x+1}$$

$$12. f(x) = \frac{1}{x}$$

$$13. f(x) = \frac{x+2}{2x-1}$$

$$14. f(x) = |x-2|$$

$$15. f(x) = \sqrt{x^2-16}$$

$$16. f(x) = \log_2(4x-8) + 3$$

$$17. f(x) = \sqrt{2x-1}$$

$$18. f(x) = \frac{2}{x^2-1}$$

$$19. f(x) = \ln(x^2-9)$$

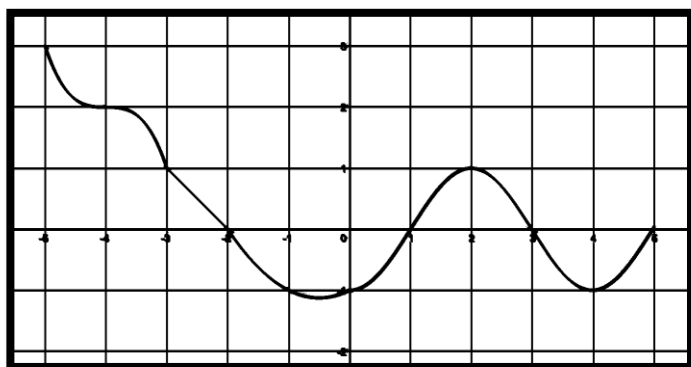
$$20. f(x) = \frac{3x+2}{(3x+2)(x+1)}$$



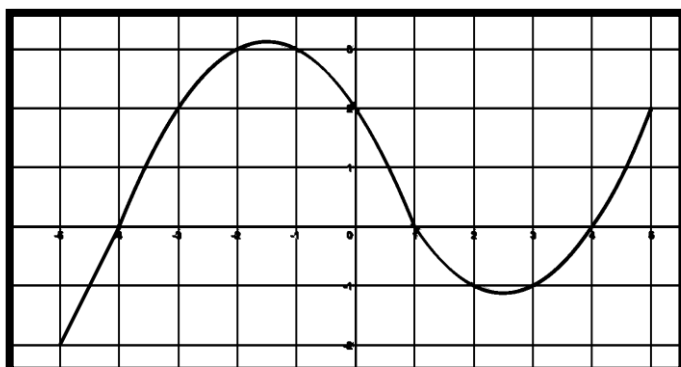
# Composition of Functions

Given the following functions  $f(x)$  and  $g(x)$ , find the following.

Graph of  $f$



Graph of  $g$



1.  $f(g(-2))$
2.  $f(g(2))$
3.  $g(f(-1))$
4.  $f(f(5))$
5.  $g(g(-2))$
6. All inputs for  $x$  for which  $g(g(x)) = -1$

Given the tables for functions  $f$  and  $g$ , find the following.

$x$	$f(x)$
-1	2
0	4
1	3
2	0
3	1
4	-1

$x$	$g(x)$
-1	3
0	4
1	2
2	6
3	2
4	-1

7.  $f(g(3))$
8.  $g(f(2))$
9.  $f(f(4))$
10.  $g(g(4))$
11. All inputs  $x$  such that  $f(g(x)) = 2$

Given the tables for functions  $f$  and  $g$ , find the following.

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

$x$	$g(x)$
-1	-2
0	2
1	3
2	1

12.  $f(f(-2))$
13.  $f(g(0))$
14.  $g(f(1))$
15. Domain of  $f(g(x))$

Let  $f(x) = 2x - 3$ ,  $g(x) = e^x$ , and  $h(x) = \ln x$ . Find a formula for each function.

16.  $f(f(x))$
17.  $f(g(x))$
18.  $g(h(x))$
19.  $h(g(x))$

Let  $f(x) = x^3$ ,  $g(x) = 5x + 1$ , and  $h(x) = 2^x$ , find the following.

20.  $f(g(x))$

21.  $h(f(x))$

22.  $h(g(x))$

23.  $g(h(x))$

24.  $g(f(x))$

25.  $f(g(h(x)))$

In the composition of functions  $f(g(x))$ ,  $g$  is known as the inner function, and  $f$  is known as the outer function. For each problem below, specify the inner and outer functions.

26.  $y = (7x - 3)^2$

27.  $y = \ln(x^2 + 4)$

28.  $y = 2^{3x-5}$

29.  $y = e^{\ln x}$

30.  $y = \sqrt{x}$

31.  $y = (\ln x)^2 + 1$

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

33.  $y = \frac{2}{(x-7)^2}$

34.  $y = \sqrt[5]{x+3}$

Answer each of the following.

35. If  $f(g(x)) = \ln(x^2 + 1)$  and  $f(x) = \ln x$ , what is  $g(x)$ ?

36. If  $f(g(x)) = \sqrt[3]{x-3}$  and  $f(x) = \sqrt[3]{x}$ , what is  $g(x)$ ?

37. If  $f(g(x)) = \sin(3x)$  and  $f(x) = \sin x$ , what is  $g(x)$ ?

# Exponentials and Logarithms

Rewrite into logarithmic form.

1.  $25^x = 5$

2.  $\frac{1}{7} = 49^x$

3.  $e^x = 54.6$

4.  $y = e^x$

Rewrite into exponential form.

5.  $\log_6 x = 2$

6.  $y = \ln x$

7.  $\log_a b = c$

8.  $\ln x = 1.946$

Evaluate without using a calculator.

9.  $\log_6 6^2$

10.  $\frac{1}{3} \ln e$

11.  $4 \log 100$

12.  $\log_5 \frac{1}{25}$

Find the value of the following without using your calculator. Show work.

13.  $3 \ln e + \ln \left(\frac{1}{e}\right)$

14.  $\ln e^2 + e^{-\ln e}$

15.  $e^{5 \ln 2}$

16.  $4 \ln e^{7x}$

Simplify to a single ln or e expression or a single number.

17.  $2 \ln a - 3 \ln b + \ln(ab)$

18.  $\ln(e^2 \ln(e \ln e))$

Express each of the following as the logarithm of a single expression. (Condense)

19.  $2 \ln x + 4 \ln y - \ln 13$

20.  $\ln 7 + 5 \ln y - \frac{1}{2} \ln x$

Use the properties of logarithms to express the following as an algebraic expression involving  $\log x$ ,  $\log y$ , and/or  $\log z$ . (Expand)

21.  $\log \frac{x^2 y^3}{z}$

22.  $\log \frac{z}{\sqrt{xy}}$

# Trig Exact Values and Inverse Trig

Evaluate each expression.

1. $\sin\left(\frac{\pi}{4}\right)$	2. $\cos(210^\circ)$	3. $\sin\left(\frac{3\pi}{4}\right)$
4. $\csc 270^\circ$	5. $\tan\left(\frac{3\pi}{2}\right)$	6. $\tan\left(\frac{5\pi}{4}\right)$
7. $\csc(2\pi)$	8. $\sec 150^\circ$	9. $\sin 2\pi$
10. $\cot 600^\circ$	11. $\cot\left(-\frac{17\pi}{6}\right)$	12. $\csc(-510^\circ)$
13. $\cos\frac{11\pi}{4}$	14. $\cot(-150^\circ)$	15. $\cos(30^\circ)$
16. $\cos\left(-\frac{\pi}{2}\right)$	17. $\tan(-225^\circ)$	18. $\cot(-3\pi)$

19. $\arcsin\left(\frac{\sqrt{3}}{2}\right)$	20. $\arccos(-1)$	21. $\tan^{-1}(-1)$
22. $\sin^{-1}(-1)$	23. $\arcsin\left(-\frac{1}{2}\right)$	24. $\arctan(-\sqrt{3})$
25. $\cos^{-1}\left(-\frac{\sqrt{2}}{2}\right)$	26. $\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)$	27. $\tan^{-1}(0)$
28. $\arcsin\left(-\frac{\sqrt{3}}{2}\right)$	29. $\cos^{-1}\left(-\frac{1}{2}\right)$	30. $\arccos\left(-\frac{\sqrt{3}}{2}\right)$

Simplify using trig identities. Write your answer as a single trig expression or a number.

31.  $\cot x \cdot \sec x$

32.  $\frac{\sin x}{\csc^2 x}$

33.  $\frac{1-\cos^2 x}{\tan^2 x}$

34.  $\sin x \cdot \csc x$

35.  $(1 - \tan^2 x)$

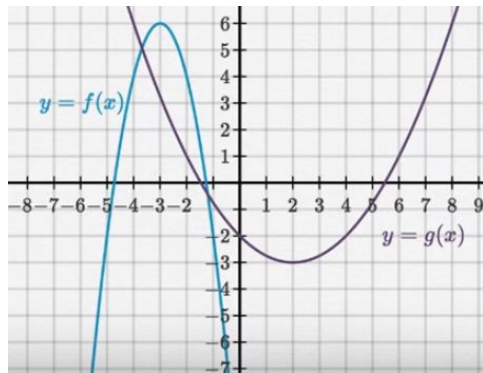
36.  $\frac{\sin^2 x + \cos^2 x}{\tan x}$

## Unit 1: Pre-Calculus Practice Test

Answer the questions below. Please be sure to highlight your final answer. To earn full credit you must show all of your work.

1. Factor Completely:  $x^2 - x - 6$
2. Factor Completely:  $x^4 - 17x^2 + 16$
3. Factor Completely:  $6x^3 + 6$
4. Factor Completely:  $6x^2 - 7x - 3$
5. Find the point-slope form of the line that passes through  $(2, -3)$  and is parallel to the line  $y = -\frac{4}{3}x + 18$
6. Find the average rate of change of  $\frac{2x+3}{x^2+2}$  on the interval  $[-1, 1]$
7. State the domain:  $f(x) = \ln(x^2 - 8x + 12)$
8. State the domain:  $f(x) = \frac{x+5}{x^2-6x+8}$
9. State the domain:  $f(x) = \sqrt[6]{x^2 - 4x - 12}$
10. Describe the transformations from the parent function:
  - a.  $f(x) = -3(x - 5)^3$
  - b.  $f(x) = -\frac{1}{2}x^2 + 3$
  - c.  $f(x) = \sqrt{x + 4} - 9$

11.



Evaluate:

- a.  $f(g(-3))$                       b.  $g(f(-4))$

13. Evaluate the following:

$$f(x) = \begin{cases} 2 \cdot 3^x + 1, & x \leq -2 \\ \sqrt{8x} + 1, & -2 < x \leq 2 \\ -|x + 1|, & x > 4 \end{cases}$$

- a.  $f(-2)$   
 b.  $f(2)$   
 c.  $f(3)$   
 d.  $f(6)$

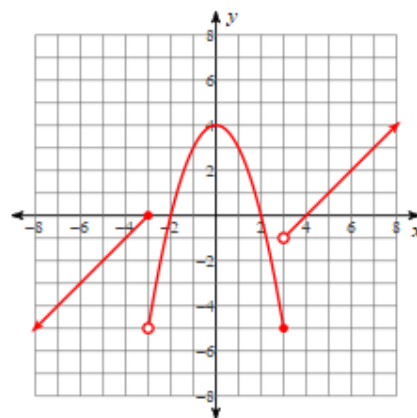
15. Evaluate:

- a.  $5e^{2 \cdot \ln 3n} =$   
 b.  $e^{\ln \sqrt{y}} =$   
 c.  $\frac{1}{2} \ln e^{5x} =$

12. Given that  $f(x) = 3(2x - 1)^2 + 1$ ,  
 $g(x) = x + 2$ , and  $h(x) = e^{2x-1} + 3$   
 Perform the indicated operation:

- a. Find  $(g \circ f)(x)$   
 b. Find  $(h \circ g)(x)$

14. Write the equation for the graph:



16. Simplify to a single expression:

- a.  $\ln(\ln e(e^7(5 \ln e^{-x})))$   
 b.  $\log(5x) - 2 \log 3 + \frac{1}{2} \log(x-3)$

17. Evaluate  $\sec\left(\frac{41\pi}{6}\right)$

18. Evaluate  $\sin\left(-\frac{14\pi}{3}\right)$

19. Evaluate  $\cot\left(\frac{11\pi}{6}\right)$

20. Evaluate  $\csc(-3\pi)$

21. Evaluate  $\arcsin\left(\frac{1}{2}\right)$

22. Evaluate  $\cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

23. Evaluate  $\arctan\left(-\frac{\sqrt{2}}{2}\right)$

24. Simplify  $\sin x \cdot \cot x$

25. Simplify  $\frac{\tan x}{\sec x}$

26. Simplify  $\sin^3 x \cdot \csc^3 x$

27. Simplify  $\frac{\sin^2 x + \cos^2 x}{\cot^2 x}$

28. Simplify  $\cos^2 x (1 + \tan^2 x)$