

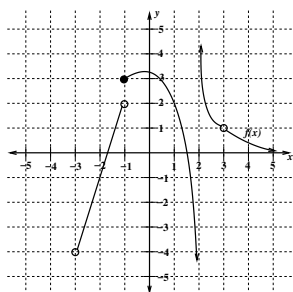
# Math 142 - Pre-Calculus Review Problems

courtesy: Kendra Kilmer  
(from Fall 2017 Math 140 WIR)

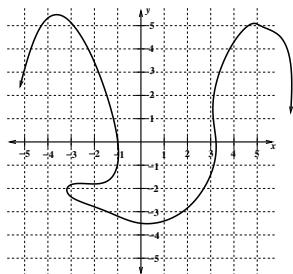
1. State the following in interval notation.

- (a)  $x \neq 3$  and  $x \neq -2$
- (b)  $x \geq 8$  and  $x \neq 2$  and  $x \neq 9$
- (c)  $x \leq 7$  or  $x > 2$
- (d)  $x > -3$  and  $x \leq 4$  and  $x \neq 1$

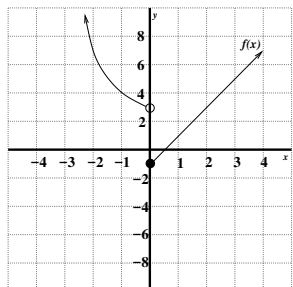
2. Does each of the following graphs represent a function? If so, find the domain and range.



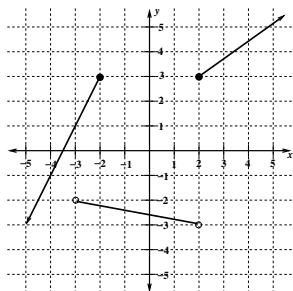
(a)



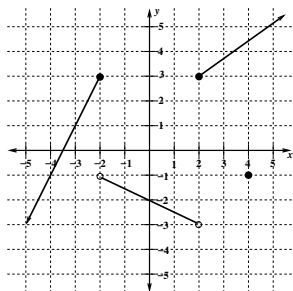
(b)



(c)

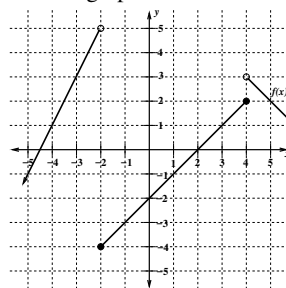


(d)



(e)

3. Use the graph below to find the following:



- (a)  $f(-3)$ ,  $f(-2)$ ,  $f(4)$
- (b) the value(s) of  $x$  such that  $f(x) = 2$
- (c) the zeros of  $f(x)$
- (d) the y-intercept of  $f(x)$
- (e) domain of  $f(x)$
- (f) range of  $f(x)$

4. If  $f(x) = 3x - 10$  and  $g(x) = 2x^2 - 7x + 3$ , find the following:

- (a)  $f(2)$
- (b)  $g(-3)$
- (c)  $f(a - 7)$
- (d)  $g(2a + 4)$
- (e)  $g(a + h) - g(a)$

5. For each of the following quadratic functions, find the (i) vertex form of the function, (ii) the zeros of the function, and (iii) the domain and range of the function.

- (a)  $g(x) = -6x^2 - 39x + 21$
- (b)  $m(x) = 2x^2 - 7x + 6$
- (c)  $f(x) = 7x^2 - 4x + 9$

6. For a particular lamp, the consumers will not purchase it at a price of \$230 but for every \$8 decrease in price the consumers are willing to purchase 24 more lamps.

- (a) Find the demand equation.
- (b) If the demand function determines the selling price, what is the revenue function?
- (c) What is the selling price when the revenue is maximized?
- (d) If each lamp costs \$20 to make and the company has a fixed cost of \$1000, what is the cost function?
- (e) How many lamps should they make and sell to maximize their profit?
- (f) How many lamps should they make and sell to break even?

7. Find the domain of each of the following functions:

- (a)  $f(x) = \frac{5x - 7}{8x - 3}$
- (b)  $h(x) = \frac{8x - 17}{3x^2 - 8x + 1}$
- (c)  $k(x) = \frac{x - 2}{x^4 + x^3 - 6x^2}$
- (d)  $m(x) = \frac{\sqrt[3]{3x - 5}}{\sqrt{5x - 9}}$
- (e)  $T(x) = \begin{cases} 5x - 7 & \text{if } x < 0 \\ 9x^2 - 9 & \text{if } 0 \leq x \leq 2 \\ \sqrt[3]{5x + 9} & \text{if } 0 \leq x \leq 2 \\ \sqrt[3]{3x - 20} & \text{if } x > 4 \end{cases}$

(f)  $f(x) = e^{\frac{x}{x-4}}$

(g)  $g(x) = \frac{x-2}{25x-4}$

8. Perform the indicated operations and simplify

(a)  $\frac{x+2}{x-4} \cdot \frac{x+7}{2x-9}$

$$\frac{x+2}{2x-7}$$

(b)  $\frac{x+7}{2x-7}$

$$\frac{3x+2}{3x+2}$$

(c)  $\frac{x^2}{7x-8} + \frac{x-2}{x+5}$

9. For each of the following functions, evaluate and simplify  $\frac{f(x+h) - f(x)}{h}$ 

(a)  $f(x) = 3x^2 - 9x + 10$

(b)  $f(x) = \frac{7}{3x-5}$

(c)  $f(x) = \sqrt{3x-8}$

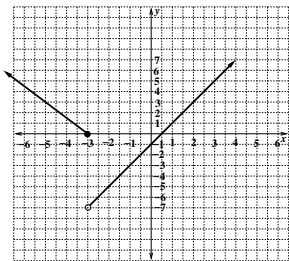
10. If  $f(x) = \begin{cases} -3x^2 + 4x - 7 & \text{if } x < 2 \\ 3^x & \text{if } 2 \leq x < 5, \\ 7x - 9 & \text{if } x > 7 \end{cases}$ , find the following.

(a)  $f(0)$

(b)  $f(2)$

(c)  $f(5)$

(d)  $f(8)$

11. Write  $f(x) = |2x - 10|$  as a piecewise defined function.12. Find a formula for the function  $f$  graphed below.13. Sketch a graph of  $f(x) = \begin{cases} -\frac{1}{2}x^2 + 7 & \text{if } -4 \leq x < 0 \\ -\frac{5}{2}x + 6 & \text{if } 2 < x \leq 4 \\ \frac{1}{4}x + 5 & \text{if } x > 4 \end{cases}$ 14. A daycare center charges \$20 to watch a child for a four hour period. For each minute during the 5th hour, they charge \$0.50 per minute. For each minute in excess of 5 hours, they charge \$1 per minute. If  $C(x)$  is the total daily cost of putting your child in the daycare for  $x$  minutes, what is  $C(x)$ ?

15. Simplify the following and express the answer without using radicals or negative exponents.

(a)  $\frac{(3x)^{-2} \sqrt{x^3 y}}{5(xy)^3 x^{-1/2}}$

(b)  $\frac{(xyz)^3}{(\sqrt[3]{xy})^{-2}}$

(c)  $\frac{(3x^3 y^6 z^{-2})^{-3}}{(2xy)^2 x y z^{-4}}$

16. Solve the following for the exact value of  $x$ .

(a)  $16^{2x+5} = 4^{3x}$

(b)  $\frac{1}{9^{3x}} = 27^{5x-7}$

(c)  $2^x \cdot x^2 - 5 \cdot 2^x \cdot x = 14 \cdot 2^x$

17. An account pays interest at a rate of 3% per year compounded continuously. If \$3,000 is placed into this account today, how much will be in the account after 8 years?

18. Susie puts her money into an account that pays 2.5% per year compounded continuously. If she has \$5,400 after 13 years, how much did she originally put into the account?

19. State the domain of each of the following functions using interval notation:

(a)  $f(x) = \frac{2x^2 + 11x - 21}{6x^3 + 45x^2 + 21x}$

(b)  $g(x) = \frac{\sqrt[8]{4x-3}}{e^x - 3}$

(c)  $h(x) = \frac{\ln(x)}{\sqrt[7]{x+3}}$

(d)  $k(x) = \begin{cases} x^2 + 7 - 2^x & \text{if } -5 < x \leq 1 \\ \frac{x+2}{x^2-3x} & \text{if } 2 \leq x < 4 \\ \sqrt[4]{x-5} & \text{if } x \geq 4 \end{cases}$

20. Solve the following equations for the exact value(s) of  $x$ :

(a)  $2x^2 - 7x + 11 = 0$

(b)  $\log_2(6x-1) + \log_2(x+2) = \log_2 19$

(c)  $3 \cdot 4^x - 5^x = 0$

(d)  $\log_3 81 - 11^{\log_{11} 5} + \log_4(4^x) = 4^{3/2}$

21. Simplify the following expressions.

(a)  $\frac{\frac{2}{3(x+h)+5} - \frac{2}{3x+5}}{h}$

(b)  $\frac{\sqrt[7]{x^3 y^{-2}} (x^3 y z^{-1})^{-2}}{(4x^2)^2 y z}$

22. The price-demand function for a particular product is  $p(x) = 522 - 4x$  where  $p(x)$  is the unit price when  $x$  units are demanded. The company making the product has a cost function of  $C(x) = 42x + 13400$  where  $x$  is the number of items made and sold. Find the number of items the company must make and sell in order to maximize its profit.23. A taxpayer in a particular country is taxed as follows. The income between \$0 and \$8,025, inclusive, is taxed at 10%. Any income over \$8,025 is taxed at 15%. Find a piecewise-defined function,  $T(x)$ , that will allow a taxpayer to determine the total amount of tax owed if they have  $x$  dollars of income.

24. An account pays interest at the rate of 5% per year compounded continuously. How long will it take for the amount placed into the account to double?

25. If  $g(x) = -3f(x-2) + 4$ , describe how the graph of  $f(x)$  would need to be transformed to get  $g(x)$ .26. If the graph of  $f(x) = x^2$  is shifted right 3 units, vertically stretched by a factor of 4, reflected about the  $x$ -axis and then shifted 2 units down, what is the equation of the resulting graph?

27. Use the table below to evaluate the following:

$x$	1	2	4	7	9	12
$f(x)$	-3	12	7	-2	10	5
$g(x)$	9	-4	11	1	5	-8

- (a)  $f(g(1))$   
 (b)  $g(f(4))$   
 (c)  $g(f(12) - 1)$
28. Expand the following function using properties of logarithms:

$$f(x) = \log_3 \left( \frac{(2x-7)^3(4x-3)}{(x+5)\sqrt{8x-9}} \right)$$

29. Find the zeros of  $f(x) = \frac{(x-2)(x+3)}{(2x-7)(5x-2)}$ .

### Multiple Choice and True/False Questions:

30. Determine whether each of the following statements is True or False.
- (a) For a quadratic function  $f(x) = ax^2 + 5x + 2$ , the minimum value of the function occurs at  $x = \frac{-5}{2a}$  for any value of  $a$ .
- (b) The graph of a polynomial is continuous for all real numbers.
- (c) If a polynomial of even degree has a negative leading coefficient, the function value will approach negative infinity as  $x$  approaches negative infinity.
- (d) If a polynomial of odd degree has a positive leading coefficient, the function value will approach positive infinity as  $x$  approaches positive infinity.
- (e) The domain of  $\sqrt[3]{7x-3}$  is  $[\frac{3}{7}, \infty)$
- (f)  $\sqrt[12]{x^{-2}y^3} = x^{-1/6}y^{1/4}$
- (g) The function,  $f(x) = 3^x$ , has a zero at  $x = 0$ .
- (h)  $4^{4^4} = e$ .
- (i) If  $f(1) = 4$ ,  $f(4) = 3$ ,  $g(2) = -2$ , and  $g(3) = 7$  then  $g(f(4)) = 1$ .
- (j) If  $f(x) = 2x^2 + 4x - 7$  then  $f(x+h) = 2x^2 + 4x - 7 + h$ .

31. The cost, in dollars, of manufacturing  $x$  units of a product is given by  $C(x) = 4x + 15000$ . The demand equation for the same product is given by  $p = -\frac{1}{500}x + 22$  where  $x$  is the quantity demanded at a unit price of  $\$p$ . If the selling price of the item is determined by the demand function, what is the maximum profit that this manufacturer can obtain?

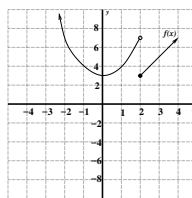
- (a) \$15,000  
 (b) \$25,000  
 (c) \$30,000  
 (d) \$25,500  
 (e) None of the above
32. If  $f(x) = 3x^2 - 4x + 7$ , find and simplify  $\frac{f(x+h) - f(x)}{h}$ .

- (a)  $6x + 3h - 4$   
 (b)  $3h - 4$   
 (c)  $\frac{-2x^2 + 2xh + h^2 - 4h}{h}$   
 (d) 1  
 (e) None of the above
33. The graph of a quadratic function that has a vertex of  $(3, -3)$ , opens down, and passes through the point  $(2, -5)$  has a  $y$ -intercept of

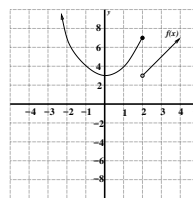
34. What is the domain of  $\frac{\sqrt{x+100}}{5 + \sqrt[3]{2x-7}}$ ?

- (a)  $[-100, -59) \cup (-59, \infty)$   
 (b)  $[3.5, \infty)$   
 (c)  $[-100, 3.5) \cup (3.5, \infty)$   
 (d)  $[-100, \infty)$   
 (e) None of the above
35. Which of the following is equivalent to  $\frac{3^x 4^{x-2}}{2^x 9^{3x}}$ ?

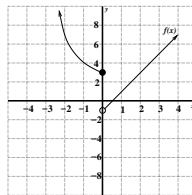
- (a)  $\frac{3^{2x}}{4}$   
 (b)  $\frac{1}{16} \left(\frac{3}{2}\right)^x \left(\frac{4}{9}\right)^{3x}$   
 (c)  $\frac{12^{2x-2}}{18^{4x}}$   
 (d)  $\frac{2^{x-4}}{3^{5x}}$   
 (e) None of the above
36. If  $f(x) = \begin{cases} x^2 + 3 & \text{if } x < 2 \\ 2x - 1 & \text{if } x \geq 2 \end{cases}$ , which graph below represents  $f(x)$ ?



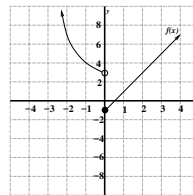
(a)



(b)



(c)



(d)

37. Determine the domain of the following function.

$$f(x) = \frac{\sqrt[3]{x-3}}{x^2 - 7x + 12}$$

- (a)  $(3, 4) \cup (4, \infty)$   
 (b)  $[3, 4) \cup (4, \infty)$   
 (c)  $(-\infty, 4) \cup (4, \infty)$   
 (d)  $(-\infty, 3) \cup (3, 4) \cup (4, \infty)$   
 (e) None of the above
38. What amount will an account have after 10 years if \$3,000 is invested at an annual rate of 3.15% compounded continuously? (Round to the nearest penny.)
- (a) \$7,110.78  
 (b) \$4,109.08  
 (c) \$70,008.19  
 (d) \$4,110.78  
 (e) None of the above

39. The demand for a particular flashlight is given by  $p = -\frac{3}{1000}x + 12$  where  $x$  is the number of flashlights demanded at a unit price of  $p$  dollars. If the demand function determines the price that the manufacturer sells the flashlight at, what unit price will maximize the revenue?

(a) \$6  
 (b) \$8  
 (c) \$2,000  
 (d) \$12,000  
 (e) None of the above

40. Given  $g(x) = -x^2 + 3x - 4$ , find  $\frac{g(x+h) - g(x)}{h}$

(a)  $\frac{2x^3 + 2xh + h^2 + 3h}{h}$   
 (b) 1  
 (c)  $3 - h + 2x$   
 (d)  $-2x - h + 3$   
 (e) None of the above

41. What is the domain of  $f(x) = \frac{\sqrt{3x-7}}{\sqrt[3]{13-4x}}$ ?

(a)  $\left[\frac{7}{3}, \frac{13}{4}\right) \cup \left(\frac{13}{4}, \infty\right)$   
 (b)  $\left[\frac{7}{3}, \infty\right)$   
 (c)  $\left[\frac{13}{4}, \infty\right)$   
 (d)  $\left(\frac{7}{3}, \frac{13}{4}\right) \cup \left(\frac{13}{4}, \infty\right)$   
 (e) None of the above

42. If  $f(x) = 2x^3 - 7x + 5$  and  $g(x) = \sqrt[5]{9x^3}$ . Which of the following is equivalent to  $f(g(x))$ ?

(a)  $2 \cdot 9^{3/5}x^{9/5} - 7 \cdot 9^{1/5}x^{3/5} + 5$   
 (b)  $9^{1/5}(2x^3 - 7x + 5)^{3/5}$   
 (c)  $2\sqrt[5]{9x} - 7\sqrt[5]{9x^3} + 5$   
 (d)  $9(2x^3 - 7x + 5)^{3/5}$   
 (e) None of the above

43. Solve the following equation for  $x$ :

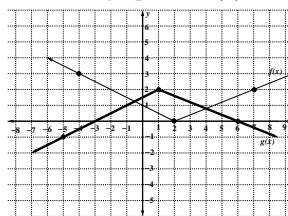
$$\log_8(2x + 11) + \log_8(x) = \log_8(6)$$

(a)  $x = 0.5$  and  $x = -6$  only  
 (b)  $x = -6$  only  
 (c)  $x = 0.5$  only  
 (d)  $x = -11/2$  and  $x = 6$  only  
 (e) None of the above

44. If  $\log_b 2 = 0.2789$  and  $\log_b 3 = 0.4421$ , what is  $\log_b \left(\frac{b^4}{18}\right)$ ?

(a) 1.1631  
 (b) 2.8369  
 (c) 4.6053  
 (d) 3.3947  
 (e) None of the above

45. Given the graphs of  $f(x)$  and  $g(x)$  below, write  $g(x)$  in terms of  $f(x)$ .



(a)  $g(x) = -f(x+1) + 2$   
 (b)  $g(x) = -f(x+2) + 1$   
 (c)  $g(x) = -f(x-1) + 2$   
 (d)  $g(x) = f(x+1) + 2$   
 (e) None of the above

46. The expression  $\frac{2e^{x+4}}{4^{x+2}e^{2x-7}}$  is equivalent to which of the following?

(a)  $2^{-2x-3}e^{-x+11}$   
 (b)  $4^{-x}e^{-x+11}$   
 (c)  $2^{-2x-4}e^{-x+11}$   
 (d)  $2^{-2x+5}e^{-x-3}$   
 (e)  $2^{5-2x}e^{-x+11}$