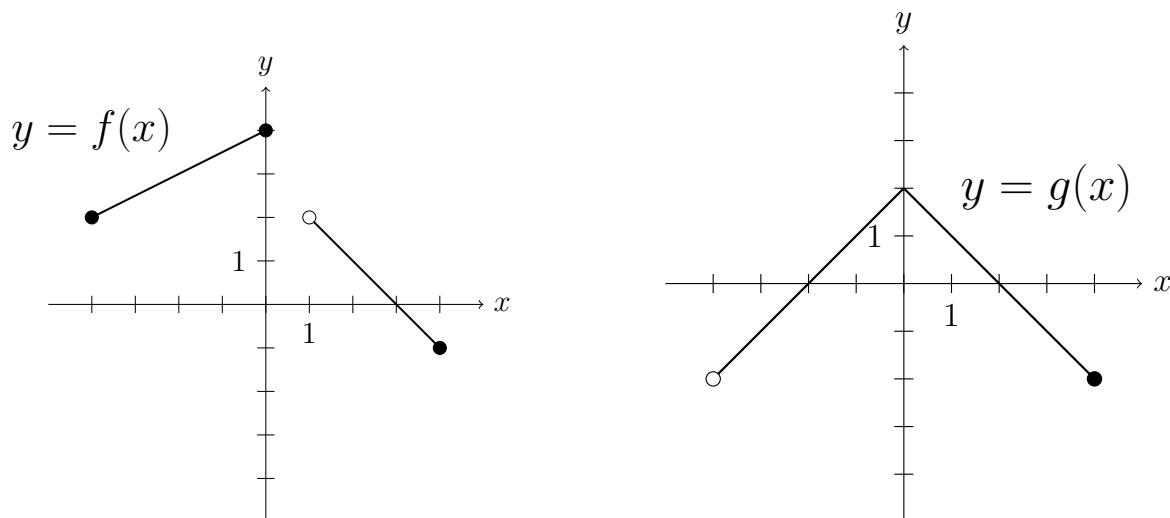


1. [9 pts] Let  $y = f(x)$  and  $y = g(x)$  be given by the graphs:



- (a) State the domain and range of  $f$ .

If possible, evaluate the following or state that it is undefined:

(b)  $(3f - 5g)(4) =$

(c)  $(f \circ g)(-1) =$

(d)  $(g \circ f)(-4) =$

(e)  $f^{-1}(2) =$

- (f) Is  $g$  invertible? Justify your answer.

- (g) Sketch a graph of  $y = -2g(x)$

2. [1 pt] Find an equation in slope-intercept form for the line passing through the point  $(3, 4)$  and perpendicular to the  $y$ -axis.

3. [4 pts] Let  $f(x) = 5 - 3x + x^2$  and  $g(x) = 4x - 6$ .

(a) Simplify  $(f \cdot g)(x)$ .

(b) Simplify  $(g \circ f)(x)$ .

4. [4 pts] Sketch a graph of  $f(x)$  defined by:

$$f(x) = \begin{cases} -\frac{x}{2} + 1 & \text{if } -4 \leq x \leq 2 \\ x - 3 & \text{if } 2 < x \leq 4 \end{cases}$$

5. [6 pts] Solve for  $x$ :

(a)  $3x^2 + 11x = 20$

(b)  $x^5 - x^4 - x^3 = 0$

(c)  $17(x - 2) < 4x - 9(x + 5)$

6. [2 pts] Solve by completing the square:  $x^2 - 16x + 62 = 0$

7. [3 pts] Given the quadratic function  $f(x) = 3x^2 - 6x + 5$ ,
- find all intercepts;
  - find the vertex; and
  - sketch its graph.
8. [2 pts] Use polynomial long division to write  $\frac{6x^5 - 17x^3 + 2x^2 - 1}{2x^2 - 5}$  in the form  $Q(x) + \frac{R(x)}{D(x)}$ .
9. [7 pts] Let  $f(x) = \frac{x^2 - 4x}{x^2 - 5x - 14}$  and  $g(x) = \frac{x}{x + 2}$ .
- Simplify  $f(x) - g(x)$ .
  - Find  $g^{-1}(x)$ .
  - Simplify  $g(g(x))$ .
10. [3 pts] Simplify  $(x^3y)^{\frac{1}{4}} \sqrt[4]{x^5y^3}$ .
11. [4 pts] Given the rational function  $f(x) = \frac{2x - 3}{x - 3}$ ,
- state its domain;
  - find all the intercepts;
  - find all asymptotes; and
  - sketch its graph.
12. [4 pts] Solve  $\frac{x + 2}{x + 1} - \frac{2x + 4}{x + 3} = \frac{2}{x^2 + 4x + 3}$ .
13. [3 pts] Rationalize the denominator (and simplify)  $f(x) = \frac{5 + 2\sqrt{3}}{7 - \sqrt{3}}$ .
14. [2 pts] Find the domain of  $f(x) = \frac{x}{\sqrt{x - 3}}$ .
15. [3 pts] Find the distance between  $(2, -3)$  and  $(-6, 1)$ .
16. [3 pts] If \$6000 is invested at 3% interest compounded monthly, find the value after 20 years. (Give your answer to the nearest cent.)
17. [3 pts] Express as a single logarithm and simplify:  $\frac{4}{3} \ln(xz) - \frac{2}{3} \ln(yz) - \frac{1}{3} \ln(xy)$ .
18. [3 pts] Express in terms of the simplest possible logarithms:  $\log \left( \frac{x^2y}{10\sqrt{zy^5}} \right)$ .
19. [2 pts] Evaluate  $\log_2(50)$  to four decimal places.
20. [4 pts] For the function  $f(x) = 2^{-x} - 8$ ,
- find the  $y$ -intercept if any,
  - find the  $x$ -intercept if any,
  - find the equation of any asymptotes,
  - sketch a graph of the function.
21. [4 pts] For the function  $g(x) = 1 - \log_3(x + 9)$ ,

- (a) find the  $y$ -intercept if any,
- (b) find the  $x$ -intercept if any,
- (c) find the equation of any asymptotes,
- (d) sketch a graph of the function.

22. [4 pts] Solve:

- (a)  $\log x + \log(x - 3) = \log 4 + 1$
- (b)  $2 \ln x = 1$

23. [4 pts] A ramp must be built to roll a cart up to a loading dock which is 2m above the ground. If the ramp is to make an angle of  $20^\circ$  with the ground, what is the horizontal distance of the ramp? Draw a sketch, solve the problem, and give your answer with two decimal places of precision.

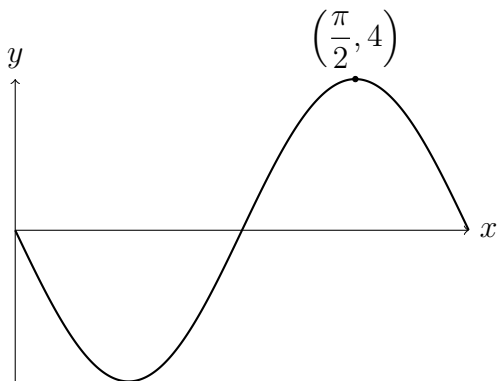
24. [1 pt] Convert  $160^\circ$  to radians. Give an exact value.

25. [2 pts] Find the exact value of  $\cot(\pi/2)$ .

26. [2 pts] Find all angles  $\theta$  in  $[0^\circ, 360^\circ)$  such that  $\cos \theta = -2/3$ . (Two decimal places.)

27. [2 pts] Find all angles  $\theta$  in  $[0, 2\pi)$  such that  $\csc \theta = -\sqrt{2}$ . Give exact values.

28. [2 pt] For the following graph, find a formula of the form  $y = a \sin(bx)$  or  $y = a \cos(bx)$ .

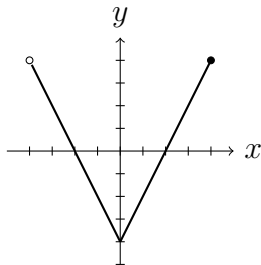


29. [3 pts] Prove the identity:  $\frac{1}{1 + \sin x} - \frac{1}{1 - \sin x} = -2 \sec x \tan x$ .

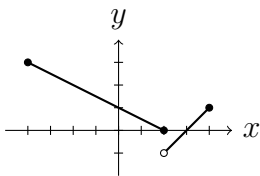
30. [4 pts] A triangle has angles with measures  $A, B, C$  across from sides of length  $a, b, c$  respectively. If  $a = 12, b = 5$ , and  $c = 10$ , find  $A, B$ , and  $C$ .

Answers

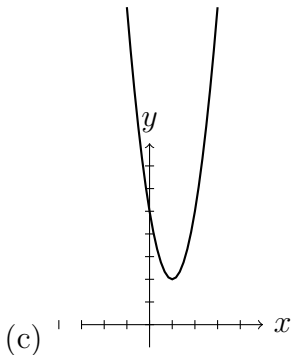
1. (a)  $D = [-4, 0] \cup (1, 4]$  and  $R = [-1, 4]$   
 (b) 7  
 (c) undefined  
 (d) 0  
 (e)  $-4$   
 (f) No. It does not satisfy the horizontal line test.



- (g)  
 2.  $y = 4$   
 3. (a)  $4x^3 - 18x^2 + 38x - 30$   
 (b)  $4x^2 - 12x + 14$

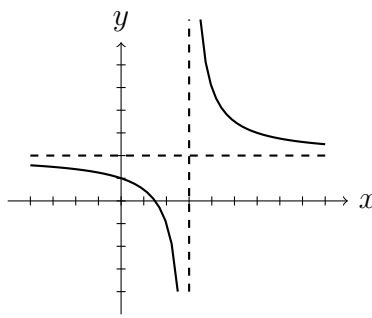


4.  
 5. (a)  $x = 4/3, x = -5$   
 (b)  $x = 0, x = \frac{1 \pm \sqrt{5}}{2}$   
 (c)  $x < -1/2$   
 6.  $x = 8 \pm \sqrt{2}$   
 7. (a)  $y$ -int:  $(0, 5)$ ; no  $x$ -int  
 (b)  $(1, 2)$



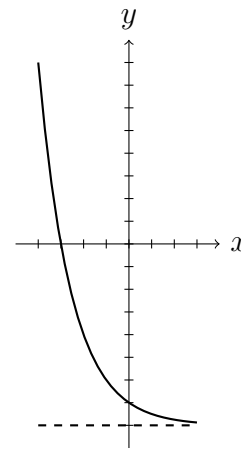
8.  $3x^3 - x + 1 + \frac{-5x+4}{2x^2-5}$   
 9. (a)  $\frac{3x}{(x+2)(x-7)}$   
 (b)  $\frac{2x}{1-x}$   
 (c)  $\frac{x}{3x+4}$

10.  $x^2y$   
 11. (a)  $\mathbb{R} \setminus \{3\}$   
 (b)  $(3/2, 0), (0, 1)$   
 (c) H.A.:  $y = 2$ ; V.A.:  $x = 3$

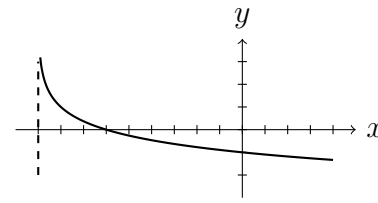


12.  $x = 0$   
 13.  $\frac{41+19\sqrt{3}}{46}$   
 14.  $(3, \infty)$   
 15.  $4\sqrt{5}$   
 16. \$10,924.53  
 17.  $\ln\left(\frac{xz^{2/3}}{y}\right)$

18.  $2 \log x - \frac{3}{2} \log y - \frac{1}{2} \log z - 1$   
 19. 5.6439  
 20. (a)  $(0, -7)$   
 (b)  $(-3, 0)$   
 (c) H.A.:  $y = -8$ ; V.A.: none



21. (a)  $(0, -1)$   
 (b)  $(-6, 0)$   
 (c) H.A.: none; V.A.:  $x = -9$



22. (a)  $x = 8$   
 (b)  $x = \sqrt{e}$

23. 5.49m

24.  $8\pi/9$  rad

25. 0

26.  $131.81^\circ, 228.19^\circ$

27.  $5\pi/4$  rad,  $7\pi/4$  rad

28.  $-4 \sin(3x)$

30.  $A \approx 100.77^\circ, B \approx 24.15^\circ$