

1. (6 points) Answer **True** or **False** for each of the following:

(a) 2 is a root of  $x^3 - x^2 - 3x + 4$ .

(b)  $-1$  is in the domain of  $f(x) = 2\sqrt{-x}$ .

(c)  $-1$  is in the range of  $f(x) = 2\sqrt{-x}$ .

(d) The function  $f(x) = |x| - x$  is symmetric with respect to the  $y$  axis.

(e) If the sides of a triangle  $ABC$  are given by  $a$ ,  $b$  and  $c$  and if  $b^2 = a^2 + c^2$  then triangle  $ABC$  must be a right triangle.

(f) If  $x$  and  $y$  are positive numbers then  $\ln(x + y) = \ln x + \ln y$ .

(g) If  $0 < x < y$  then  $|x - y| = |y| - |x|$ .

(h)  $\cos(.15)$  is in the interval  $[0, 1/2)$ .

2. (3 points) Solve the inequality  $|2 + 4x| \leq 3$

3. (3 points) Solve the inequality

$$\frac{x - 2}{x} \leq 3$$

4. (3 points) Find an equation for the parabola which passes through the origin and has a vertex at  $(3, 1)$ .

5. (7 points) Given the points  $A(-12, 17)$  and  $B(2, 10)$

(a) Find an equation for the line through  $A$  and  $B$ .

(b) Find an equation for the line through the origin that is perpendicular to the line through  $A$  and  $B$ .

(c) Find the midpoint of  $A$  and  $B$ .

(d) Is the point  $(-5, 13)$  closer to  $B$  or  $A$ ? Justify your answer.

6. (6 points) Let  $f(x) = \frac{x}{x+1}$  and  $g(x) = \frac{x}{x-1}$

(a) Find and simplify  $f(g(x))$ .

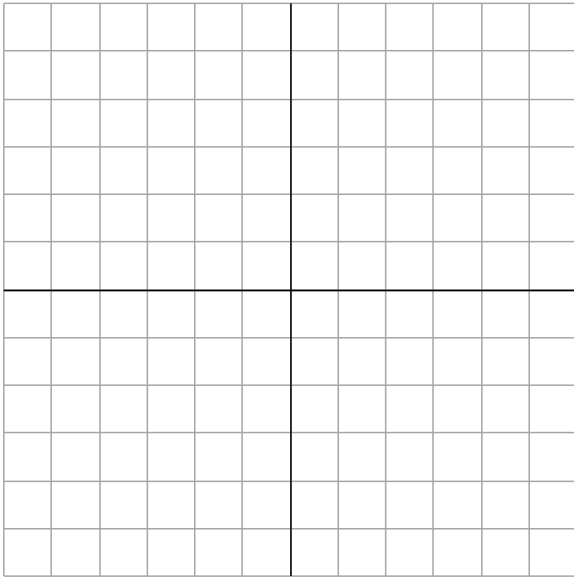
(b) Find  $f^{-1}(x)$ .

(c) Find all values of  $x$  such that  $g(x) = x$ .

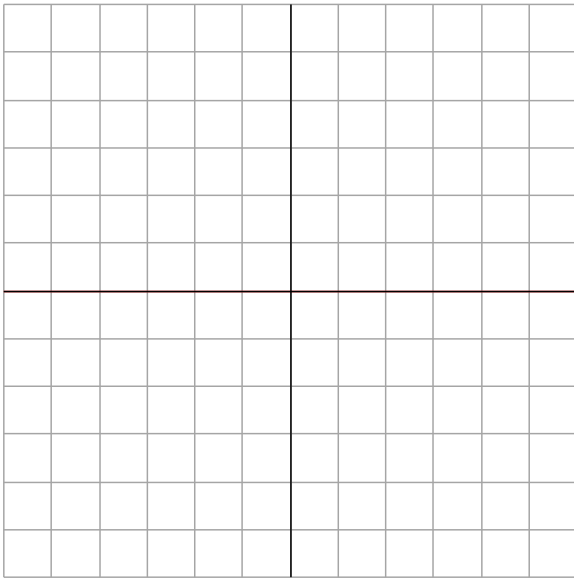
7. (4 points) Plot the function

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

What is the domain and range of  $f(x)$ ?

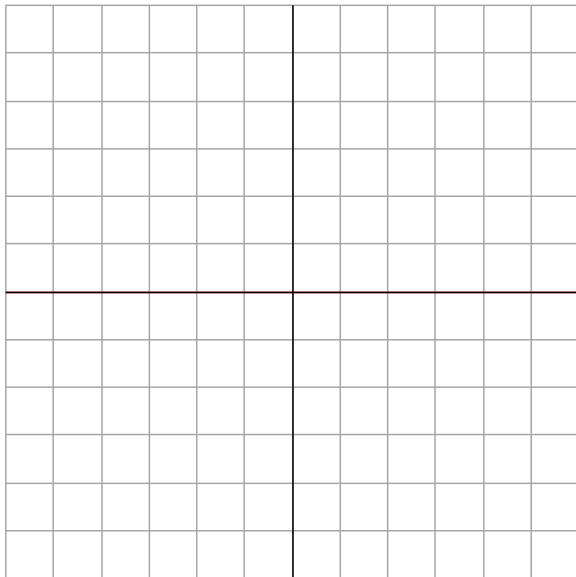


8. (4 points) Plot the function  $f(x) = 4x^2 + 7x - 2$ . Give coordinates for the vertex and any intercepts.

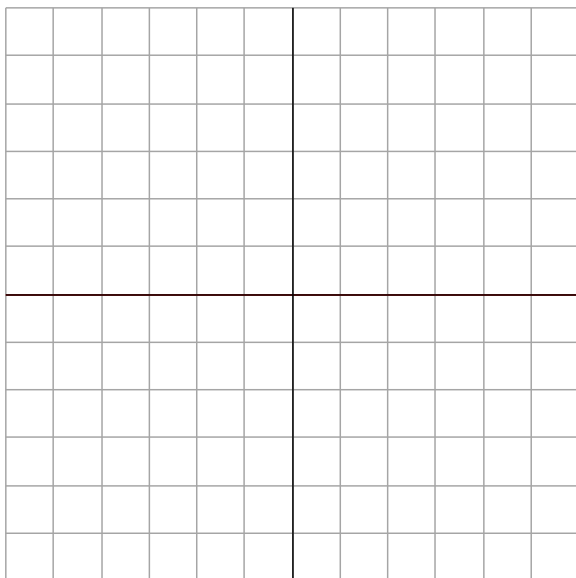


What is the domain and range of  $f(x)$ ?

9. (4 points) Plot the function  $f(x) = \frac{2x^2 + 1}{x^2 - 4}$  including any intercepts and asymptotes.



10. (4 points) Plot the function  $f(x) = 1 + \log_2(x + 1)$  including any asymptotes and intercepts.

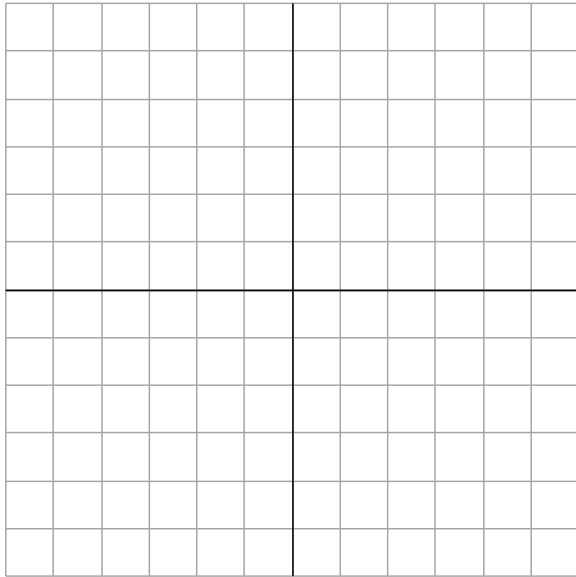


What is the domain and range of  $f(x)$ ?

11. (4 points) Plot the function

$$g(x) = \begin{cases} 2e^x & \text{if } x < 0 \\ 2e^{-x} & \text{if } x \geq 0 \end{cases}$$

including any asymptotes and intercepts.



What is the domain and range of  $g(x)$ ?

12. (9 points) Solve each of the following equations for  $x$ . Give the **exact value** for your solutions. NO CREDIT will be given for decimal approximations.

(a)  $\frac{3}{x-2} - \frac{2}{x} = 1$

(b)  $2 \log_3(x-3) = -1$

(c)  $\cos(x) - \sin(2x) = 0$  where  $0 \leq x < 2\pi$

13. (6 points) Solve the following equations for  $x$ . Give your answers in decimal notation accurate to 3 decimal places.

(a)  $\log_2(1-2x) + \log_2(1-x) = 1$

(b)  $4e^{-2x} = 55$

(c)  $\ln(4.52x - 3.88) = 2.37$

14. (5 points) Let  $f(x) = 3 - 2\sqrt{x}$ .

(a) Evaluate and simplify  $\frac{f(x+h) - f(x)}{h}$

(b) Evaluate and simplify  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ .

15. (3 points) Find the quotient and remainder for

$$\frac{2x^4 + 1}{x^2 + x}$$

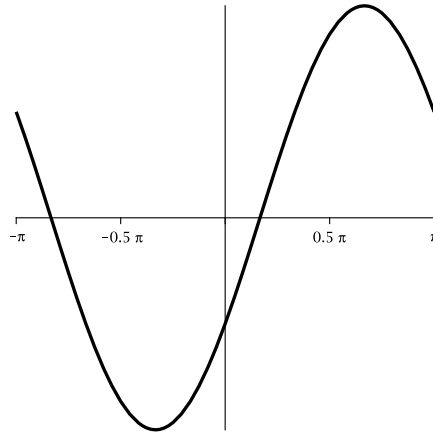
16. (5 points) Let  $f(x) = 3x^4 + 8x^3 - 37x^2 - 2x + 40$ .

(a) Which of the values -1, 0, 1, 2 are roots of  $f(x)$ ?

(b) Use the previous result to factor  $f(x)$  completely.

17. (5 points) Let  $f(t) = 2 \sin\left(t - \frac{\pi}{6}\right)$  and  $g(t) = \cos\left(\frac{1}{2}t\right)$ . The following plot shows the graph of  $f(t)$  on the interval  $[-\pi, \pi]$ .

- (a) Find the exact values of all intercepts of  $f(t)$  shown in the plot.  
 (b) Add the graph of  $g(t)$  to the plot.  
 (c) What are the periods of these two functions?



18. (2 points) If  $\theta$  is in the fourth quadrant fill in the exact values of the missing entries in the following table

$\cos \theta$	$\sin \theta$	$\tan \theta$	$\cot \theta$	$\sec \theta$	$\csc \theta$
		-2			

19. (2 points) Give the exact value of the following. No credit will be given for decimal approximations. You might find the following identities helpful

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

- (a)  $\tan \frac{7\pi}{4}$   
 (b)  $\cos 15^\circ$  (HINT:  $15^\circ = 60^\circ - 45^\circ$ )
20. (4 points) Prove the following trig identities:  
 (a)  $\sin 4\theta = 4 \sin \theta \cos^3 \theta - 4 \sin^3 \theta \cos \theta$   
 (b)  $\frac{\cos x - \sec x}{\sin x - \csc x} = \tan^3 x$
21. (2 points) Express  $\frac{\sec^2 \theta}{\tan^3 \theta}$  in terms of  $\sin \theta$  and  $\cos \theta$  in simplest form.
22. (3 points) Suppose  $\theta$  is an angle in quadrant 2 with  $\cos \theta = -1/2$ , and  $\phi$  is an angle in quadrant 3 with  $\cos \phi = -\frac{1}{3}$ . Find  $\sin(\theta + \phi)$
23. (3 points) In triangle  $ABC$  you are given  $a = 6$ ,  $B = 25^\circ$  and  $C = 40^\circ$ . Find  $c$  (accurate to 3 decimal places).
24. (3 points) Two boats leave the same port at 1:00. One boat is traveling due east at 66 k/hr and the other is travelling at an angle of  $73^\circ$  north of east at 48 k/hr. What is the distance between the boats at 1:30 (accurate to 3 decimal places)?

ANSWERS:

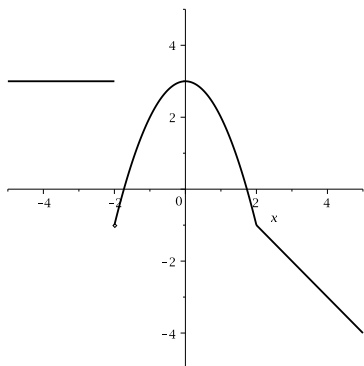
1. (a) F (b) T (c) F (d) F (e) T (f) F (g) T (h) F  
 2.  $-5/4 \leq x \leq 1/4$

3.  $x \leq -1$  or  $x > 0$

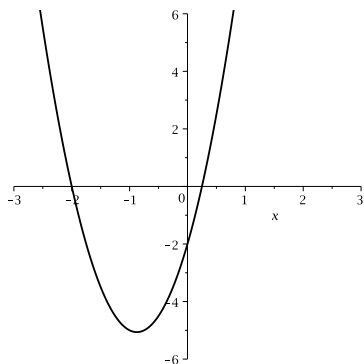
4.  $y = -\frac{1}{9}(x - 3)^2 + 1$

5. (a)  $y = -1/2x + 11$  (b)  $y = 2x$  (c)  $(-5, 27/2)$  (d) closer to B

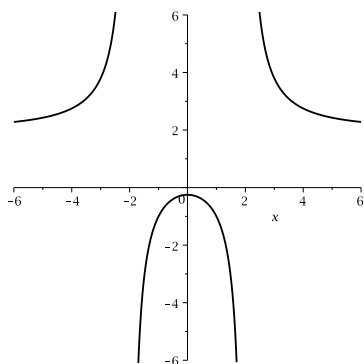
6. (a)  $\frac{x}{2x-1}$  (b)  $\frac{x}{1-x}$  (c)  $x = 0, 2$



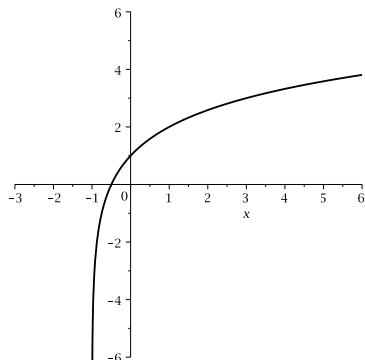
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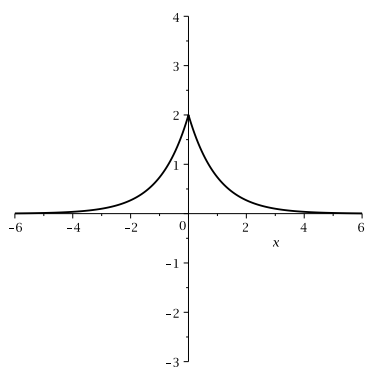
8.



9.



10.



11.

12. (a) 4, -1 (b)  $3 + \frac{1}{3}\sqrt{3}$  (c)  $\pm \frac{\pi}{2}, \frac{5\pi}{6}, \frac{7\pi}{6}$

13. (a) -0.281 (b) -1.311 (c) 3.226

14. (a)  $\frac{-2\sqrt{x+h}-2\sqrt{x}}{h} = \frac{-2}{\sqrt{x+h}+\sqrt{x}}$  (b)  $\frac{-1}{\sqrt{x}}$

15. quotient:  $2x^2 - 2x + 2$ , remainder:  $-2x + 1$

16. (a) -1 and 2 (b)  $(x+5)(x-2)(3x-4)(x+1)$

17. (a) y-intercept: (0,-1) x-intercepts:  $(\pi/6, 0)$  and  $(-5\pi/6, 0)$ . (b) (c) period of f(t):  $2\pi$ , period of g(t):  $4\pi$

18. bottom row:  $1/\sqrt{5}, -2/\sqrt{5}, -2, -1/2, \sqrt{5}, -\sqrt{5}/2$

19. (a) -1 (b)  $\frac{\sqrt{2}+\sqrt{6}}{4}$

20. (a) start with  $\cos(4\theta) = 2\sin(2\theta)\cos(2\theta)$  (b) start by expressing the left hand side in terms of sine and cosine

21.  $\frac{\cos \theta}{\sin^3 \theta}$

22.  $\frac{\sqrt{8}-\sqrt{3}}{6}$

23. 4.255

24. 34.7 km