1. Find all real solutions of each equation. If there is no real solution, state so.

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

   (b) $\dfrac{1}{3}|2x + 1| - 1 = 3$

   (c) $x^2 + 3x = 28$

   (d) $x^2 + x + 1 = 0$

   (e) $\dfrac{1}{x} + \dfrac{2}{x - 1} = 3$

2. Solve each equation for x:

   (a) $S = xy + yz + xz$

   (b) $A = x(2x + 5)$

3. Solve the inequality $x^2 \geq x + 2$, and express the solution using interval notation.

4. A jeweler has 5 rings, each weighing 20 g, made of an alloy of 10% silver and 90% gold. She decides to melt down the rings and add enough silver to reduce the gold content to 75%. How much silver should she add?

5. Mike drove from New City to Old Village at an average speed of 60 m/h to visit his parents. On the way back he needed to speed up to catch a baseball game with a friend, so he drove at 75 m/h. His trip involved a total of 5 hours of driving time. What is the distance between New City and Old Village?

6. A rectangular sheet of metal is 4 in. longer than its width. Each diagonal between opposite corners is 10 in. What are the dimensions of the sheet?

7. Given two points $A(1, -2)$ and $B(3, 2)$, find the following:

   (a) the distance between A and B

   (b) the midpoint between A and B

   (c) an equation of the circle centered at A and through B

   (d) an equation of the line through A and B

   (e) an equation of the perpendicular bisector of the line segment from A to B

8. For the circle given by the equation $x^2 + y^2 - x + 4y = 1$, find its center and radius.

9. Given two functions:

$$f(x) = \sqrt{1 - 2x} \qquad \text{and} \qquad g(x) = \begin{cases} -1 & \text{if } x < -2 \\ x + 1 & \text{if } -2 \leq x \leq 1 \\ 2x^2 & \text{if } x > 1 \end{cases}$$

   (a) What is the domain of f?

(b) Find the following values:

$f(-4) =$

$g(0) =$

$g(10) =$
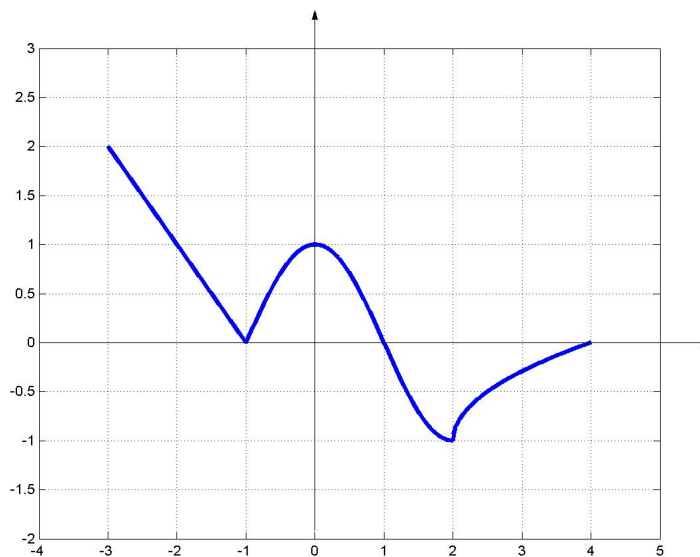
$(f \circ g)(-1) =$

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

$\dfrac{f(\frac{1}{2}) - f(-2)}{g(\frac{1}{2}) - g(-2)} =$

10. For $f(t) = \dfrac{2}{t+2}$, find the average rate of change from $t = a$ to $t = a + h$

11. The graph of the function $f(x)$ is given below.

(a) The domain of f is _____ and the range of f is _____

(b) Find all values of x for which $f(x) = 1$:

(c) Find all values of x for which $f(x) < 0$:

(d) Find the interval(s) in which f is increasing:

(e) Find the interval(s) in which f is decreasing:

(f) The absolute maximum of f is _____ when $x =$_____

(g) The absolute minimum of f is _____ when $x =$_____

(h) Find the value $(f \circ f)(2)$:

(i) Find the average rate of change of f from $x = -2$ to $x = 2$:

12. For the parabola given by $f(x) = -x^2 + 14x - 10$,

(a) Find its vertex.

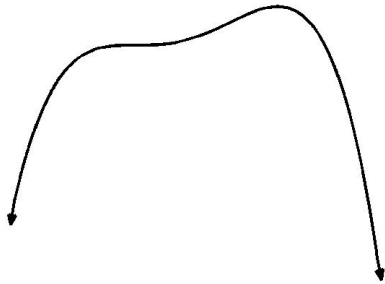(b) Determine if it has a maximum or minimum value, and find this value.

13. Let
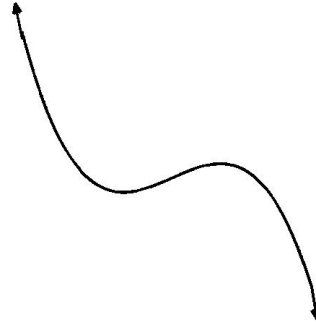
$$f(x) = 5x^{128} - \frac{1}{2}x^{127} + \cdots - 2010, \qquad g(x) = -\frac{1}{5}x^{128} + 2x^{126} + \cdots - 2010,$$

$$F(x) = \frac{1}{3}x^{129} + \frac{1}{5}x^{128} + \cdots + 2010, \qquad G(x) = -3x^{129} - 5x^{127} + \cdots + 2010.$$

(I)   (II)

(a) (I) can only be the graph of which function: f, g, F, or G?   (Circle one)

(b) (II) can only be the graph of which function: f, g, F, or G?   (Circle one)

14. For the rational function $R(x) = \dfrac{(200x+1)(x-100)}{(100x-1)(x+200)}$,

(a) What is the domain of R?

(b) Write down the equation for each vertical asymptote (if any):

(c) Write down the equation for each horizontal asymptote (if any):

(d) Find the y-intercept (if any):

(e) Find all x-intercepts (if any):

15. If the graph of the exponential function $f(x) = e^{ax}$ passes through the point $(2, 3)$, what is a?

16. If the graph of the logarithmic function $f(x) = \log_2(5x + b)$ passes through the point $(2, 3)$, what is b?

17. Use the change of base formula to evaluate $\log_{129} \pi$ (correct to 2 decimal places).

18. A 16g sample of radioactive material decays in such a way that the mass remaining after t days is given by $m(t) = 16e^{-0.02t}$ (in grams). After how many days is there only 4g remaining? (Round your answer to the nearest whole number.)

19. Solve each equation for x, correct to 2 decimal places:

(a) $3^x = e^{x+3}$

(b) $\log_{10}(1 + x) = 1 + \log_{10} x$

(c) $\dfrac{e^x - e^{-x}}{2} = 1$