1. Find the center and radius of the circle with the following equation:

$3x^2+3y^2+18x+6y-60=0$.

1) $C(3,1),\ \ r=\sqrt{30}$
2) $C(3,1),\ \ r=30$
3) $C(-3,-1),\ \ r=\sqrt{30}$
4) $C(-3,-1),\ \ r=30$
5) $C(9,3),\ \ r=\sqrt{110}$
6) $C(9,3),\ \ r=110$
7) $C(-9,-3),\ \ r=\sqrt{110}$
8) $C(-9,-3),\ \ r=110$
9) None of the above

2. Hooke's law states that the force F required to stretch a spring x units beyond its natural length is directly proportional to x. A force of 6 pounds stretches a certain spring from its natural length of 20 inches to a length of 22 inches. Find the force that will stretch the spring from its natural length to 29 inches.

1) 87 pounds
2) $\frac{58}{3}$ pounds
3) $\frac{29}{3}$ pounds
4) $\frac{87}{11}$ pounds
5) 3 pounds
6) $\frac{21}{11}$ pounds
7) $\frac{12}{7}$ pounds
8) $\frac{4}{3}$ pounds
9) None of the above

3. Solve for x. Find all solutions.

$x^3-64=0$

1) $x=4$
2) $x=-4$
3) $x=-4,4$
4) $x=-2\pm 2\sqrt{3}\,i$
5) $x=4,-2\pm 2\sqrt{3}\,i$
6) $x=-4,-2\pm 2\sqrt{3}\,i$
7) $x=-2\pm 4\sqrt{3}\,i$
8) $x=4,-2\pm 4\sqrt{3}\,i$
9) $x=-4,-2\pm 4\sqrt{3}\,i$

4. Given $f(x)=x^2-4$ and $g(x)=\sqrt{x+2}$, find $(g\circ f)(7)$.

1) 5
2) $\sqrt{5}$
3) 45
4) $\sqrt{45}$
5) 47
6) $\sqrt{47}$
7) $\sqrt{77}$
8) 77
9) None of the above

5. Find the domain of the function $f(x)=\dfrac{1}{\sqrt{x^2-5x-14}}$.

1) $(-\infty,-2]\cup[7,\infty)$
2) $[-2,\infty)$
3) $[-2,7]$
4) $[7,\infty)$
5) $(-\infty,-2)\cup(7,\infty)$
6) $(-2,\infty)$
7) $(-2,7)$
8) $(7,\infty)$
9) None of the above

6. Solve the inequality.

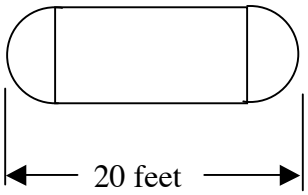
$|x+6|+17\geq 25$

1) $(-14,2)$
2) $[-14,2]$
3) $[-14,\infty)$
4) $(-\infty,\infty)$
5) $(-\infty,-48]\cup[2,\infty)$
6) $[2,\infty)$
7) $[-48,2]$
8) $(-48,2)$
9) None of the above

7. If an object is projected vertically upward from ground level with an initial velocity of 150 meters per second, then its height in meters, *s*, above the ground after *t* seconds is given by $s = -10t^2 + 150t$. For what values of *t* will the object be more than 440 meters above the ground?

1) $4 < t < 7.5$ seconds
2) $4 < t < 11$ seconds
3) $7.5 < t < 11$ seconds
4) $7.5 < t < 15$ seconds
5) $t > 4$ seconds
6) $t > 7.5$ seconds
7) $t > 11$ seconds
8) $t > 15$ seconds
9) None of the above

8. A three-dimensional storage tank is to be constructed in the shape of a right circular cylinder with a hemisphere attached to each end of the cylinder. The length of the tank is to be 20 feet. If r denotes the radius of the hemispheres, find a formula for the volume of the tank.



1) $V = 20\pi r^2 - \frac{1}{3}\pi r^3$
2) $V = 20\pi r^2 + \frac{1}{3}\pi r^3$
3) $V = 20\pi r^2 - \frac{2}{3}\pi r^3$
4) $V = 20\pi r^2 + \frac{2}{3}\pi r^3$
5) $V = 20\pi r^2 - \frac{4}{3}\pi r^3$
6) $V = 20\pi r^2 + \frac{4}{3}\pi r^3$
7) $V = 20\pi r^2 - \frac{8}{3}\pi r^3$
8) $V = 20\pi r^2 + \frac{8}{3}\pi r^3$
9) None of the above

9. Find all the points on the *y*-axis that are a distance 13 from the point $(5,-3)$.

1) (0,1) and (0,–7)
2) (0,1)
3) (0,–7)
4) $(0,3\sqrt{15})$ and $(0,-3\sqrt{15})$
5) $(0,3\sqrt{15})$
6) $(0,-3\sqrt{15})$
7) (0,9) and (0,–15)
8) (0,9)
9) (0,–15)

10. Let $f(x)=\frac{3}{x}$. Simplify the difference quotient $\frac{f(x+h)-f(x)}{h}$, where $h\neq 0$.

1) $\frac{3}{h}$

2) $\frac{3}{h^2}$

3) $\frac{3-3h}{xh^2}$

4) $-\frac{3h^2}{x(x+h)}$

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

6) $-\frac{3h}{x(x+h)}$

7) $\frac{3h}{x(x+h)}$

8) $-\frac{3}{x(x+h)}$

9) $\frac{3}{x(x+h)}$

11. Consider $g(x)=\frac{9x}{x+9}$. Find $g\left(\sqrt{a}\right)$, given that a is a positive real number. Simplify your answer.

1) $\frac{9(a-9\sqrt{a})}{a+9}$

2) $\frac{3(a-3\sqrt{a})}{a+9}$

3) $\frac{3\sqrt{a^2+9a}}{a+9}$

4) $\frac{9(a-9\sqrt{a})}{a-81}$

5) $\frac{3(a-3\sqrt{a})}{a-81}$

6) $\frac{3\sqrt{a^2+9a}}{a-81}$

7) $\frac{9(a-9\sqrt{a})}{a-9}$

8) $\frac{3(a-3\sqrt{a})}{a-9}$

9) $\frac{3\sqrt{a^2+9a}}{a-9}$

12. A music CD sells for \$15. The musician receives 10% of the selling price as a royalty for each copy of the CD sold up to 1000 copies. For any additional copies sold beyond 1000, the musician receives 20% of the selling price as a royalty. Find a piece-wise defined function ***R*** that gives the total amount of royalties earned by the musician if ***x*** copies of the CD are sold.

1) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 4.5x+1500 & \text{if } x>1000\end{cases}$

2) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 4.5x & \text{if } x>1000\end{cases}$

3) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 4.5x-1500 & \text{if } x>1000\end{cases}$

4) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 4.5x-3000 & \text{if } x>1000\end{cases}$

5) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 3x+3000 & \text{if } x>1000\end{cases}$

6) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 3x+1500 & \text{if } x>1000\end{cases}$

7) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 3x & \text{if } x>1000\end{cases}$

8) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 3x-1500 & \text{if } x>1000\end{cases}$

9) $R(x)=\begin{cases}1.5x & \text{if } 0\le x\le 1000\\ 3x-3000 & \text{if } x>1000\end{cases}$

13. Given the graph of $y=f(x)$, the graph of $g(x)=2f(x)-5$ can be obtained by using graphical transformations applied to the graph of ***f***. Which of the following sequences of transformations is correct?

1) shift right 5 units, then vertical stretch by factor 2
2) vertical stretch by factor 2, then shift right 5 units
3) shift down 5 units, then vertical stretch by factor 2
4) vertical stretch by factor 2, then shift down 5 units
5) shift right 5 units, then horizontal stretch by factor 2
6) horizontal stretch by factor 2, then shift right 5 units
7) shift down 5 units, then horizontal stretch by factor 2
8) horizontal stretch by factor 2, then shift down 5 units
9) None of the above

14. Find an equation of the perpendicular bisector of the segment AB with points $A(0,0)$ and $B(6,4)$.

1) $y=-\frac{3}{2}x$
2) $y=-\frac{2}{3}x$
3) $y=\frac{2}{3}x$
4) $y-4=-\frac{3}{2}(x-6)$
5) $y-4=-\frac{2}{3}(x-6)$
6) $y-4=\frac{2}{3}(x-6)$
7) $y-2=-\frac{3}{2}(x-3)$
8) $y-2=-\frac{2}{3}(x-3)$
9) $y-2=\frac{2}{3}(x-3)$

15. Find an equation of a rational function, $\boldsymbol{f}$, that satisfies the given conditions.

no zeros
vertical asymptote: $x=-1$
horizontal asymptote: $y=0$
$f(1)=2$
$f(x)>0$: $(-\infty,-1)\cup(-1,\infty)$
$f(x)<0$: none

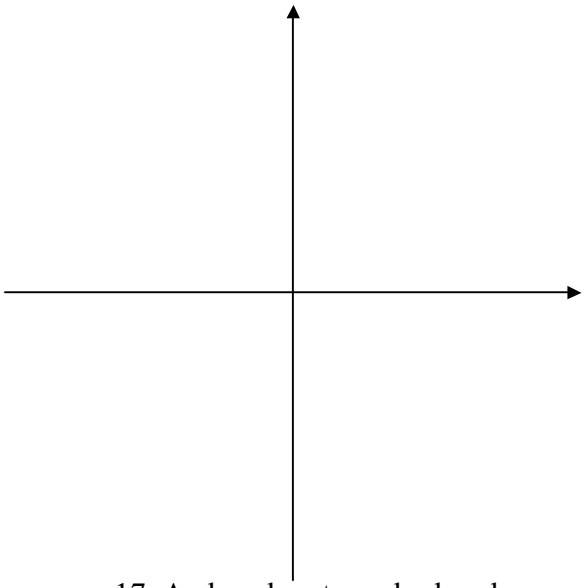
1) $f(x)=\dfrac{16}{x+1}$
2) $f(x)=\dfrac{8}{x+1}$
3) $f(x)=\dfrac{4}{x+1}$
4) $f(x)=\dfrac{16}{(x+1)^2}$
5) $f(x)=\dfrac{8}{(x+1)^2}$
6) $f(x)=\dfrac{4}{(x+1)^2}$
7) $f(x)=\dfrac{16}{(x+1)^3}$
8) $f(x)=\dfrac{8}{(x+1)^3}$
9) $f(x)=\dfrac{4}{(x+1)^3}$

16. Which of the following are true of the function $f(x) = -3x^2 - 6x - 6$?

I. A zero of f is –2.

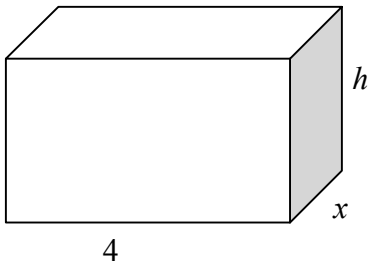
II. f has a y-intercept at $(0, 6)$.

III. The minimum value of f is –1.



1) I only
2) II only
3) III only
4) I and II only
5) I and III only
6) II and III only
7) I, II, and III
8) Cannot be determined
9) None of the above

17. A closed rectangular box has a volume of 20 cubic inches. The length of the box is 4 inches. If x denotes the width of the box (in inches) and h denotes the height of the box (in inches), express the surface area of the box, S, as a function of x.



1) $S(x) = 40 + \frac{160}{x} + 8x$
2) $S(x) = 10 + \frac{40}{x} + 8x$
3) $S(x) = 10 + \frac{40}{x} + 4x$
4) $S(x) = \frac{40}{x} + 8x$
5) $S(x) = 18x + 40$
6) $S(x) = 4x^2$
7) $S(x) = 2x^2 + 16x$
8) $S(x) = 2x^2 + 12x$
9) $S(x) = 4x\left(\frac{10 - 4x}{x + 4}\right)$

18. Which of the following are true of the function $f(x)=\dfrac{x^2}{x^2-4}$?

I. The range of the function is $(-\infty,0]\cup(1,\infty)$

II. f has a x - intercept at $(2,0)$

III. The graph of f is decreasing on the interval $(-2,0]$

1) I
2) II
3) III
4) I and II
5) I and III
6) II and III
7) I, II, and III
8) Cannot be determined
9) None of the above

19. Find the maximum vertical distance between the graphs of $y_1=-x^2+4x$ and $y_2=x$, when $0\le x\le 3$.

1) 3
2) 2.75
3) 2.50
4) 2.25
5) 2
6) 1.75
7) 1.50
8) 1.25
9) 1