Multiple Choice Questions

1. Consider the following function: $g(x) = x^2 - 9$. Find $g(9-t)$.
   A. $g(9-t) = t^2 + 18t + 72$
   B. $g(9-t) = t^2 - 18t + 72$
   C. ~~$g(9-t) = t^2 + 18t$~~
   D. $g(9-t) = t^2 - 18t - 72$.
   E. $g(9-t) = t^2 - 18t$

$g(9-t) = (9-t)^2 - 9$

$= 81 - 18t + t^2 - 9$

$= 72 - 18t + t^2$

2. Find the values of x for which $f(x) = g(x)$ where

$$f(x) = 2x^2 - x + 1 \quad \text{and} \quad g(x) = x^2 - 4x + 4.$$

   A. $x = \dfrac{-3 \pm \sqrt{21}}{2}$.
   B. $x = -3 \pm \sqrt{21}$.
   C. $x = \dfrac{-3}{2} \pm \sqrt{21}$.
   D. $x = -3 \pm \dfrac{\sqrt{21}}{2}$.
   E. $x = \dfrac{3}{2} \pm \sqrt{21}$.

$2x^2 - x + 1 = x^2 - 4x + 4$

$x^2 + 3x - 3 = 0$

$x = \dfrac{-3 \pm \sqrt{(3)^2 - 4(1)(-3)}}{2(1)}$

$= \dfrac{-3 \pm \sqrt{9+12}}{2}$

$= \dfrac{-3 \pm \sqrt{21}}{2}$

3. Find all real solutions of the equation

$$2x^2 + 5x - 4 = 0.$$

A. $\dfrac{5 \pm \sqrt{57}}{4}$

B. $\dfrac{-5 \pm \sqrt{57}}{4}$

C. $\dfrac{-5 \pm \sqrt{7}}{4}$

D. $\dfrac{-5 \pm \sqrt{57}}{2}$

E. no real solutions

$$\frac{-5 \pm \sqrt{25-4(2)(-4)}}{2(2)}$$

$$\frac{-5 \pm \sqrt{57}}{4}$$

4. Evaluate the expression $||-7|-|-4||$ $= |7-4| = 3$

A. -11

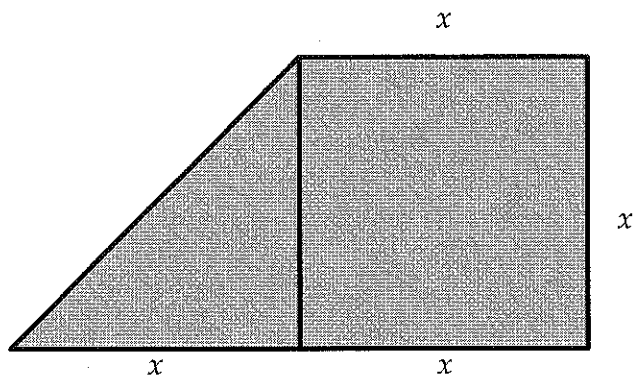
B. -3

C. 0

D. 3

E. 11

5. Find the length x in the figure, if the shaded area is 96 in^2.



A. 8.00 in
B. 9.00 in
C. 9.80 in
D. 11.31 in
E. 48.00 in

$A = \frac{1}{2}bh + wh$

$96 = \frac{1}{2}(x)(x) + (x)(x)$

$96 = \frac{3}{2}x^2$

$64 = x^2$

$8 = x$

6. Solve the equation $7x - 3 = 8x + 8$ for x.

A. -11
B. -5
C. 5
D. 6
E. 11

$7x - 3 = 8x + 8$
$-7x \qquad -7x$

$-3 = x + 8$
$-8 \qquad -8$

$-11 = x$

7. For the points (1,5) and (4,1), find the distance between them and find the midpoint of the line segment that joins them.

   A. The distance is 5;
   the midpoint is $\left(\frac{5}{2},3\right)$.

   B. The distance is 25;
   the midpoint is $\left(\frac{5}{2},3\right)$.

   C. The distance is 5;
   the midpoint is (5,3).

   D. The distance is 25;
   the midpoint is (5,3).

   E. The distance is 5;
   the midpoint is $\left(3,-\frac{5}{2}\right)$.

$d = \sqrt{(1-4)^2 + (5-1)^2}$

$= \sqrt{(-3)^2 + (4)^2}$

$= \sqrt{9+16} = 5$

m.p. $= \left(\frac{1+4}{2}, \frac{5+1}{2}\right)$

$= \left(\frac{5}{2}, \frac{6}{2}\right)$

$= \left(\frac{5}{2}, 3\right)$

8. Do the graphs of $y = -3x^2 + 6x - \frac{1}{2}$ and $y = \sqrt{7 - \frac{7}{9}x^2}$ intersect in the viewing rectangle $[-4,4]$ by $[-1,3]$? Determine the number of points of intersection.

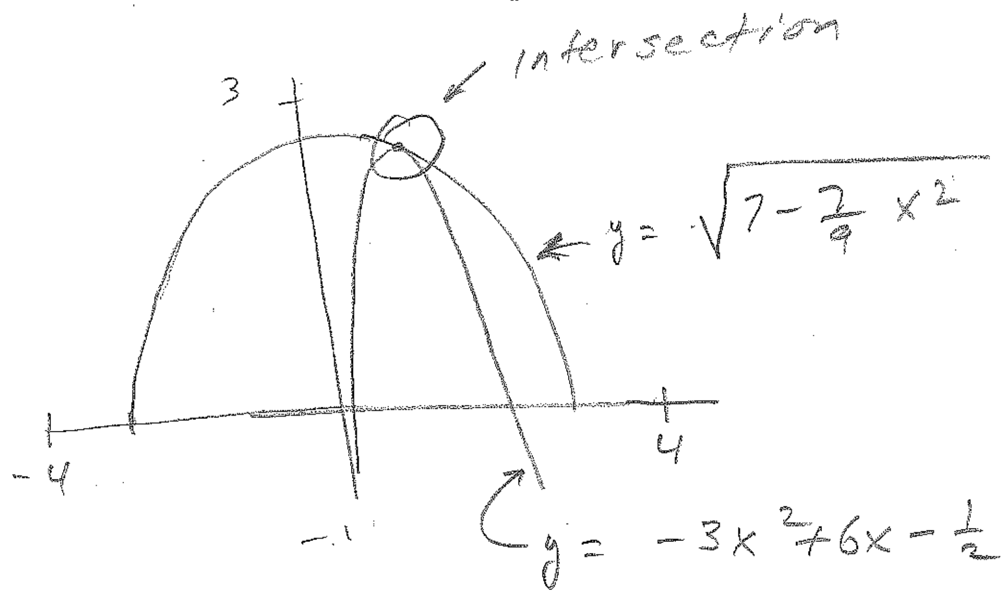
   A. 0

   B. 1

   C. 2

   D. 3

   E. 5



9. Which of the following is a correct equation for the line passing through the point $(3,19)$ and the point $(10,1)$.

   A. $7y+18x+187=0$

   B. $7y+18x-187=0$

   C. $7y-18x-187=0$

   D. $7y-18x+187=0$

   E. none of these

$m = \frac{19-1}{3-10} = \frac{18}{-7}$

$(y-19) = -\frac{18}{7}(x-3)$

$7y - 133 = -18x + 54$

$7y + 18x - 187 = 0$

10. Express the following rule in function notation:
"square, add 5, then take the square root"

   A. $f(x)=\sqrt{x^2+5}$

   B. $f(x)=\sqrt{\sqrt{x}+5}$

   C. $f(x)=(\sqrt{x}+5)^2$

   D. $f(x)=\sqrt{(x+5)^2}$

   E. $f(x)=\left(\sqrt{x}+\sqrt{5}\right)^2$

$f(x) = \sqrt{x^2+5}$

Free Response Questions

11. If $f(x) = 6x^2 - x$, find the difference quotient, $\dfrac{f(x+h) - f(x)}{h}$ if $h \neq 0$ **and** simplify.

$$\frac{6(x+h)^2 - (x+h) - (6x^2 - x)}{h} = \frac{\cancel{6x^2} + 12xh + 6h^2 \cancel{-x} - h - \cancel{6x^2} \cancel{+x}}{h}$$

$$= \frac{12xh + 6h^2 - h}{\cancel{h}} = \boxed{12x + 6h - 1}$$

12. Let

$$g(x) = \begin{cases} x+1 & \text{if } x \leq 2 \quad A \\ |x-12| & \text{if } 2 < x \leq 5 \quad B \\ x^2 - 1 & \text{if } 5 \leq x < 7 \quad C \\ \frac{1}{x} & \text{if } x \geq 7 \quad D, E \end{cases}$$

Find

A. $g(1) = 1 + 1 = 2$

B. $g(3) = |3 - 12| = 9$

C. $g(5) = 5^2 - 1 = 24$

D. $g(7) = \frac{1}{7}$

E. $g(9) = \frac{1}{9}$

13. Find the distance between $-2/7$ and 2. (Exact distance, no approximation)

$$d = \left|-\frac{2}{7} - 2\right| = \left|-\frac{2}{7} - \frac{14}{7}\right| = \left|-\frac{16}{7}\right| = \frac{16}{7}$$

14. Due to the curvature of the earth, the maximum distance D that you can see from the top of a tall building of height h is estimated by the formula

$$D = \sqrt{2rh + h^2},$$

where $r = 3960$ mi is the radius of the earth and D and h are also measured in miles. How far can you see from the observation deck of the tower, 820 ft above the ground? [NOTE: h is in miles and there are 5280 feet in one mile.

$r = 3960 \qquad h = \frac{820}{5280}$

$$D = \sqrt{2(3960) + \left(\frac{820}{5280}\right)^2} = \sqrt{7920 + \frac{672400}{27878400}}$$

$$= \sqrt{7920.24119} = \underline{88.9957 \text{ miles}}$$

15. Solve the equation

$$\frac{6}{x-5}+\frac{2}{x+5}=\frac{84}{x^2-25}.$$

L.C.D. $= (x-5)(x+5)$

$(x-5)(x+5)\left(\frac{6}{x-5}+\frac{2}{x+5}\right) = \frac{84}{\cancel{(x-5)(x+5)}}\ \cancel{(x-5)(x+5)}$

$6(x+5) + 2(x-5) = 84$

$6x+30+2x-10 = 84$

$8x = 64$

$x = 8$

Check!! $\frac{6}{8-5}+\frac{2}{8+5} = \frac{6}{3}+\frac{2}{13} = \frac{28}{13}$

$\frac{84}{64-25} = \frac{84}{39} = \frac{28}{13}$

16. Find a number b such that the given equation has exactly one real solution.

$$x^2+bx+4=0$$

$\boxed{b^2-4ac=0} \rightarrow$ one solution

$b^2-4(1)(4)=0$

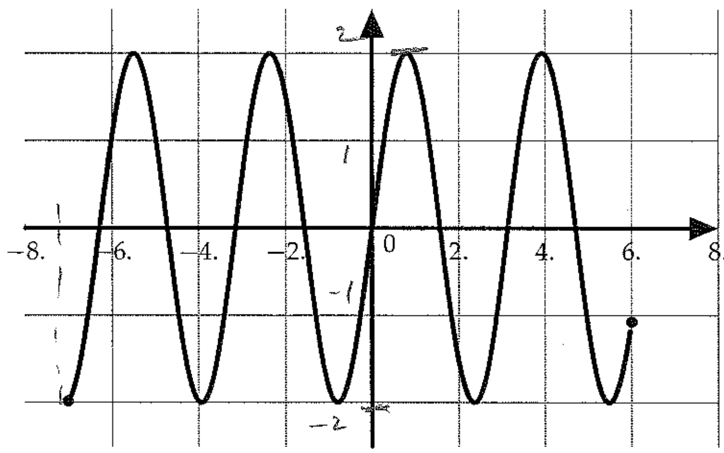
$b^2=16$

$b=4, \quad b=-4$

17. Determine the average rate of change of the function $f(x) = x^3 - 8x^2$ between $x = 0$ and $x = 3$.

Not on this exam

18. Find the domain and range of the function. Express your answers in interval notation.



$-7 \le x \le 6$

Domain: [-7, 6]

Range: [-2, 2]

19. Find an equation of the line through $A = (-2,2)$ which is perpendicular to the line through $P = (6,3)$ and $Q = (-6,3)$.

$m = \frac{3-3}{6-(-6)} = \frac{0}{12} = 0$ (horizontal)

$\Rightarrow$ perpendicular line is vertical with $(-2,2)$ on it.

$\boxed{X = 2}$

20. The projected number of scheduled passengers on U. S. commercial airlines (in billions) is given in the following table.

Year	1998	2002	2006	2010	2014
Passengers	0.552	0.552	0.657	0.630	0.663

(I) Find the equation of the line through the first data point and the last data point.

~~(II) Compute the residuals for this line.~~

(III) Compute the sum of the squares of the residuals for this line.

The least squares line of best fit is $y = 0.0071x - 13.644$ where x is the calendar year.

(IV) Compute the residuals for the least squares line of best fit.

(V) Compute the sum of the squares of the residuals for the least squares line of best fit.

Not on this exam

END OF TEST