1. Which of the following represent (list all that qualify for each and be able to support your answer)

   (a) relations _a, b, c, d, e, f_   and (b) functions _a, c, d, f_

   a. $\{(1,2), (2, 3), (-1, 4), (-3, -2)\}$ b. $\{(-3,2), (1, 3), (-5, 4), (-3, -2)\}$
   c. $f(x) = x + 2$ d. $f(x) = x^2 - 3x + 4$
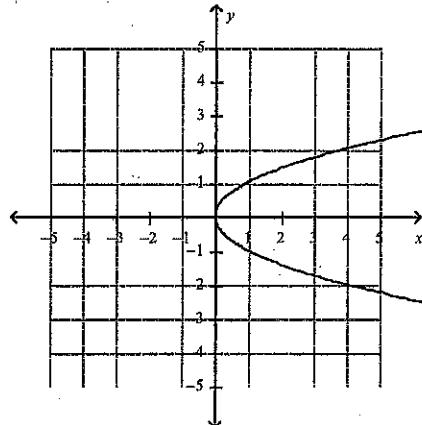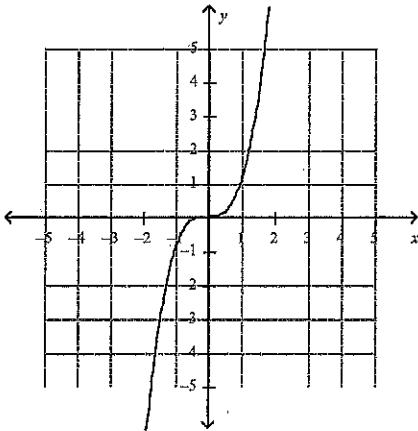
   e.   f.

2. Find the domain and range for each of the following functions.   (Use appropriate set builder notation)

   a. $y = \lceil x \rceil$ b. $f(x) = 5(2^x)$ c. $y = \dfrac{2}{-x}$ d. $f(t) = -2t^2 - 18$

   $\{x \mid x \in \mathbb{R}\}$ $\{x \mid x \in \mathbb{R}\}$ $\{x \mid x \neq 0, x \in \mathbb{R}\}$ $\{x \mid x \in \mathbb{R}\}$

   $\{y \mid y \in \mathbb{Z}\}$ $\{y \mid y > 0, y \in \mathbb{R}\}$ $\{y \mid y \neq 0, y \in \mathbb{R}\}$ $\{y \mid y \leq 18, y \in \mathbb{R}\}$

3. Let $f(x) = 9x - 2$ $g(x) = 2x$ $h(x) = x^2 - 3x$ $d(x) = \dfrac{1}{x+1}$ $k(x) = \dfrac{1}{2}x$

   a. Evaluate f(g(-1))

   $g(-1) = 2(-1) = -2$
   $f(-2) = 9(-2) - 2 = -20$

   b. Evaluate g(f(-1))

   $f(-1) = 9(-1) - 2 = -11$
   $g(-11) = 2(-11) = -22$

   c. Evaluate g(d(3))

   $d(3) = \dfrac{1}{3+1} = \dfrac{1}{4}$
   $g\left(\dfrac{1}{4}\right) = 2\left(\dfrac{1}{4}\right) = \dfrac{1}{2}$

   d. Find the simplified equation for f(g(x))

   $f(g(x)) = 9(2x) - 2$
   $= 18x - 2$

   e. Find the simplified equation for h(g(x))

   $h(g(x)) = (2x)^2 - 3(2x)$
   $= 4x^2 - 6x$

   f. Are g(x) and f(x) inverses? (show work)

   $f(g(x)) = 18x - 2$ $g(f(x)) = 2(9x-2)$
   $= 18x - 4$

   No

   g. Are g(x) and k(x) inverses? (show work)

   $g(k(x)) = 2\left(\dfrac{1}{2}x\right) = x$
   $k(g(x)) = \dfrac{1}{2}(2x) = x$

   Yes

4. Which translation has the effect on a graph of moving each point 3 units down and 8 units to the right? *(Circle one)*

a. $T(x,y) = (x-3, y+8)$ b. $T(x,y) = (x+8, y-3)$ c. $T(x,y) = (x-8, y+3)$ d. $T(x,y) = (x-8, y-3)$

5. Which dilation/scale change has the effect on a graph of *stretching* horizontally by a <u>factor</u> of 15 and *shrinking* vertically by a <u>factor</u> of 6? *(Circle one)*

a. $S(x,y) = (15x, 6y)$ b. $S(x,y) = \left(\dfrac{x}{15}, 6y\right)$ c. $S(x,y) = \left(15x, \dfrac{y}{6}\right)$ d. $S(x,y) = \left(\dfrac{x}{15}, \dfrac{y}{6}\right)$

6. Find an equation (in y= form) for the image of $y = x^2$ under the transformation:

   a. $T(x,y) = (x+3, y-2)$ b. $S(x,y) = \left(5x, \dfrac{y}{2}\right)$

   $y = (x-3)^2 - 2$ $y = \dfrac{x^2}{50}$

   Describe in words what happened to the parent function after each transformation:

   a. Moved 3 units right and 2 units down

   b. Stretch Horiz. by a factor of 5
      Shrink vert. by a factor of $\frac{1}{2}$

7. Find the equation (in y= form) for the image of $y = |x|$ under the transformation.

   a. $T(x,y) = (x-3, y+4)$ b. $S(x,y) = \left(\dfrac{x}{3}, 4y\right)$

   $y = |x+3| + 4$ $\dfrac{y}{4} = |3x|$

                                                 $y = 4|3x|$

8. What is the rule for the transformation that maps $y = \sqrt{x}$ onto the graph $y = \sqrt{10x}$

   a. Describe: Horizontally shrink by factor of 10

   b. $(x, y) \rightarrow \left(\dfrac{x}{10}, y\right)$

9. What is the rule for the transformation that maps the graph of $y = \dfrac{1}{x}$ onto the graph of $y = \dfrac{3}{2x}$?

   a. Describe: Shrink horiz by $\frac{1}{2}$
      stretch vert. by 3

   b. $(x, y) \rightarrow \left(\dfrac{x}{2}, 3y\right)$

10. What transformation maps the graph of $y = 5^x$ onto the graph of $y = 5^x + 9$?

     a. Describe: _moved up 9_   b. $(x, y) \rightarrow$ _$(x, y+9)$_

11. What transformation maps the graph of $y = \sqrt{x}$ onto the graph of $y = \sqrt{x+25} - 18$?

     a. Describe: _Left by 25_ _Down 18_   b. $(x, y) \rightarrow$ _$(x-25, y-18)$_

12. Determine if each function is odd, even, or neither. If the function is odd or even, prove it.

     a. $f(x) = 8x^3$ b. $f(x) = 5x^2 - x^4$ c. $f(x) = |3x - 4|$ d. $f(x) = |x| - 3$

odd   _even_   _Neither_   _even_

$f(-x) = 8(-x)^3$ $f(-x) = 5(-x)^2 - (-x)^4$ $f(-x) = |-x| - 3$

$= -8x^3$ $= 5x^2 - x^4$ $= |x| - 3$

$f(-x) = -f(x)$ $f(-x) = f(x)$ $f(-x) = f(x)$

13. If (p,q) is a point on the graph of a relation, what point must be on the graph of its inverse? *(Circle one)*

     a. $(-p, q)$ b. $(p, -q)$ c. $(-p, -q)$ **d. (q,p)**
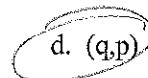
Use the graph to the right to answer questions 14-18.

14. Give the formal name and equation for this parent function.

     Inverse (Reciprocal) $y = \frac{1}{x}$

15. What kind of symmetry does this graph have?

     Point Symmetry _(Symmetric to the origin)_

16. Justify your answer to #15.

     $f(-x) = \frac{1}{-x}$

     $= -\left(\frac{1}{x}\right)$

     $f(-x) = -f(x)$
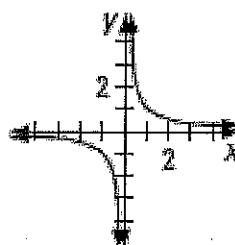
17. Which graph is the inverse of this function?

$x = \frac{1}{y} \Rightarrow y = \frac{1}{x}$

(a) (b) (c) (d)
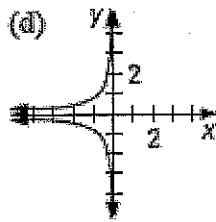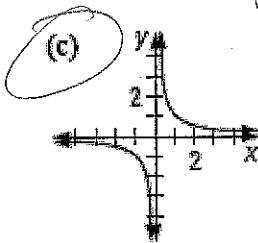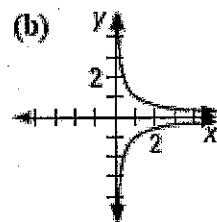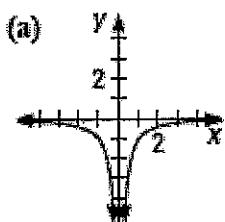
18. Is the inverse a function? Justify your answer.

Yes, it passes the vertical line test and the original passes the horizontal line test.

19. Find the equation of the inverse to the following equations:

a. $y = 2x + 7$

$x = 2y + 7$

$\frac{x - 7}{2} = y$

b. $y = \dfrac{2}{x+1}$

$x = \frac{2}{y+1}$

$x(y+1) = 2$

$y = \frac{2}{x} - 1$

c. $y = 5x^2$

$x = 5y^2$

$\pm\sqrt{\frac{x}{5}} = y$

Function: Y or N   Function: Y or N   Function: Y or N

20. Write the inverse of the given relation: $\{(0,1), (1,1), (2,2), (3,3), (4,5)\}$ (No function)

$\{(1,0), (1,1), (2,2), (3,3), (5,4)\}$

21. a) A manufacturing company packs boxes of whiteboard marker 4-packs to be shipped to various retail stores such as Staples. Each box can fit 36 packs. Write an equation that would represent the number of boxes B to hold x number of whiteboard marker packets.

$B(x) = \left\lceil \dfrac{x}{36} \right\rceil$

b) Use your equation to determine how many boxes will be needed for 375 packs of markers.

$B(375) = \left\lceil \dfrac{375}{36} \right\rceil = \lceil 10.42 \rceil = 11$

c) Sketch a graph of this situation.