

**Unit 4**

State how many complex zeros the function has and identify as real and non-real.

1.  $f(x) = x^2 - 2x + 7$

2 complex:  
0 real, 2 non-real

2.  $f(x) = x^3 - x + 3$

3 complex:  
1 real, 2 non-real

3.  $f(x) = x^4 - 2x^2 + 3x - 4$

4 complex:  
2 real, 2 non-real

4.  $f(x) = x^5 - 2x^2 - 3x + 6$

6 complex:  
1 real, 4 non-real

Write a polynomial in factored form given the following zeros.

5.  $x = 1, 3i$

$(x-1)(x-3i)(x+3i)$

6.  $x = 3, -2$  (mult of 2),  $4i$

$(x-3)(x+2)^2(x-4i)(x+4i)$

Use the given zero to find all the zeros of the function.

7.  $-4; x^3 + 4x^2 + 25x + 100$

$$\begin{array}{r|rrrr} -4 & 1 & 4 & 25 & 100 \\ & \downarrow & -4 & 0 & -100 \\ \hline & 1 & 0 & 25 & 0 \end{array}$$

$x = -4, \pm 5i$

$x^2 + 25 = 0$

$x^2 = -25$

$x = \pm 5i$

8.  $2; x^4 - x^3 - x^2 - x - 2$

rational root thm:  $x = \pm \frac{1, 2}{1} = \pm 1, 2$

$$\begin{array}{r|rrrrr} 2 & 1 & -1 & -1 & -1 & -2 \\ & \downarrow & 2 & 2 & 2 & 2 \\ \hline -1 & 1 & 1 & 1 & 1 & 0 \\ & \downarrow & -1 & 0 & 0 & \\ \hline & 1 & 0 & 1 & 0 & \end{array}$$

$x = 2, -1, \pm i$

$x^2 + 1 = 0 \rightarrow x = \pm i$

9.  $3i, f(x) = x^3 + x^2 + 9x + 9$

$(x-3i)(x+3i)$   
 $x^2 + 3ix - 3ix - 9i^2$   
 $x^2 + 9$

$x^2 + 0x + 9$   
 $\begin{array}{r} x+1 \\ \hline x^3 + x^2 + 9x + 9 \\ - (x^3 + 0x^2 + 9x) \\ \hline x^2 + 0x + 9 \\ - (x^2 + 0x + 9) \\ \hline 0 \end{array}$

$x+1=0$   
 $x=-1$

$x = -1, \pm 3i$

**Unit 5**

Convert the radical to exponent form and vice versa:

10.  $(\sqrt{x})^4$

$x^{\frac{4}{3}}$

11.  $x^{\frac{8}{3}}$

$(\sqrt[3]{x})^8$

Solve the following equations, check for extraneous solutions:

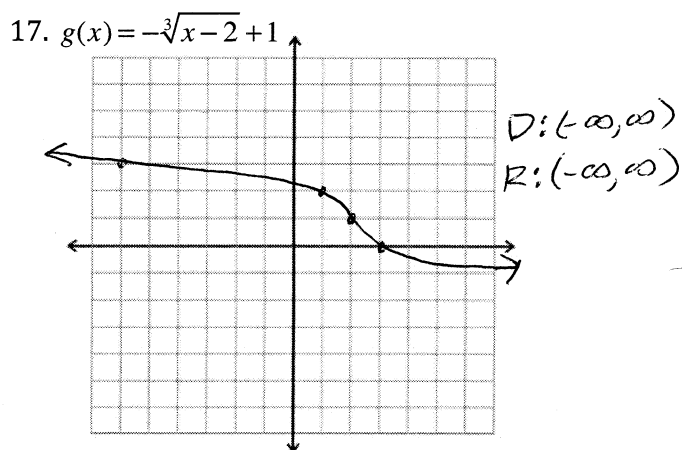
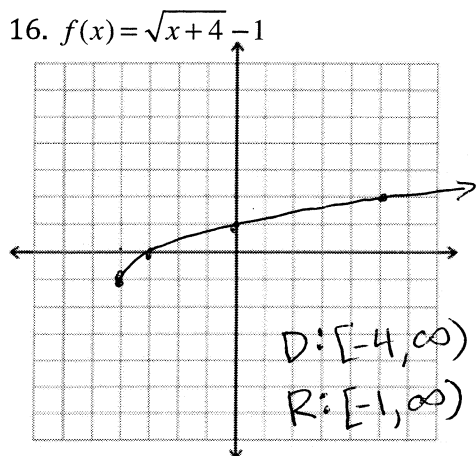
12.  $\sqrt{x-1} = 5$   
 $x-1 = 25$   
 $x = 26$   
 check:  $\sqrt{26-1} = 5$   
 $\sqrt{25} = 5$   
 $5 = 5$

13.  $(x-6)^2 = \sqrt{18-3x}$   
 $x^2 - 12x + 36 = 18 - 3x$   
 $x^2 - 9x + 18 = 0$   
 $(x-3)(x-6) = 0$   
 $x = 3$  (extr.)  
 $x = 6$   
 check:  $3-6 = \sqrt{18-3(3)}$   
 $-3 = \sqrt{9}$   
 $-3 \neq 3$   
 check:  $6-6 = \sqrt{18-3(6)}$   
 $0 = \sqrt{0}$   
 $0 = 0$

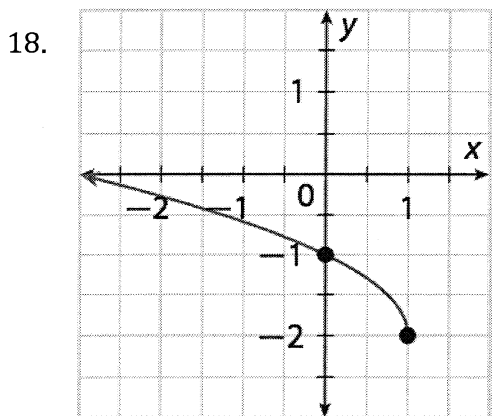
14.  $(x+4)^{\frac{1}{2}} = 6$   
 $x+4 = 36$   
 $x = 32$   
 check:  $(32+4)^{\frac{1}{2}} = 6$   
 $36^{\frac{1}{2}} = 6$   
 $6 = 6$

15.  $(x-6)^{\frac{1}{2}} = (x-2)^2$   
 $x-6 = x^2 - 4x + 4$   
 $0 = x^2 - 5x + 10$   
 $x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(10)}}{2(1)}$   
 $x = \frac{5 \pm \sqrt{25-40}}{2} = \frac{5 \pm \sqrt{-15}}{2} = \frac{5 \pm i\sqrt{15}}{2}$

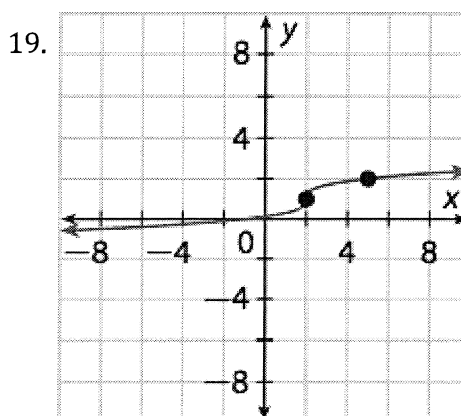
Graph the following and state the domain and range:



Write the equation for the following graphs:



$f(x) = \sqrt{-(x-0)} - 1$



$g(x) = \frac{1}{3} \sqrt[3]{x-2} + 1$

**Unit 6**

Perform the following operations. List excluded values.

20. Divide  $\frac{x+2}{x-4} \div \frac{x}{3x-12}$   $x \neq 4, 0$

$$\frac{x+2}{\cancel{x-4}} \cdot \frac{\cancel{3(x-4)}}{x} = \frac{3(x+2)}{x}$$

21. Multiply  $\frac{(x-5)(x+1)}{3x-15} \cdot \frac{4}{(x-3)(x+1)}$   $x \neq 5, 3, -1$

$$= \frac{4}{3(x-3)}$$

22. Add.  $\frac{1}{3+x} + \frac{3-x}{x}$   $x \neq -3, 0$   
LCD:  $x(3+x)$

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

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

23. Subtract.  $\frac{4}{(x+1)(x-1)} - \frac{x+2}{x-1}$   $x \neq -1, 1$   
LCD:  $(x+1)(x-1)$

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

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

Solve the following rational equations. Be cautious of extraneous solutions.

24.  $\frac{2x}{x-1} + \frac{1}{x-3} = \frac{2}{(x-1)(x-3)}$   $x \neq 1, 3$   
LCD:  $(x-1)(x-3)$

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

$$2x^2 - (2x + x - 1) = 2$$

$$2x^2 - 5x + 3 = 0$$

$$(2x+1)(x-3) = 0$$

$$x = -1/2 \quad x = 3$$

$x = -1/2$

25.  $f(x) = \sqrt[3]{x-5}$

$$0 = \sqrt[3]{x-5}$$

$$5 = \sqrt[3]{x}$$

$x = 125$

check:  $\sqrt[3]{125} - 5 = 0$   
 $5 - 5 = 0$   
 $0 = 0$

26. It takes 1.5 hours for Tim to mow the lawn. Linda can mow the same lawn in 2 hours. How long will it take John and Linda, work together, to mow the lawn?

$$\frac{1}{1.5} + \frac{1}{2} = \frac{1}{x}$$

$$2x + 1.5x = 3$$

$$3.5x = 3$$

$x = .86 \text{ hrs.}$

Find the inverse of the following:

27.  $f(x) = \frac{2x-3}{x+1}$

$$y = \frac{2x-3}{x+1}$$

$$xy - 2y = -x - 3$$

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

$$y = \frac{-x-3}{x-2}$$

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

$$\frac{(y+1)x = 2y-3}{y+1} \cdot \frac{(y+1)}{y+1}$$

$$x(y+1) = 2y-3$$

$$xy + x = 2y - 3$$

28.  $f(x) = \sqrt[3]{x-5}$

$$y = \sqrt[3]{x-5}$$

$$x = \sqrt[3]{y-5}$$

$$(x+5)^3 = \sqrt[3]{y-5}^3$$

$$y = (x+5)^3$$

$$y = (x+5)(x+5)(x+5)$$

$$y = (x+5)(x^2+10x+25)$$

$$\rightarrow y = x^3 + 15x^2 + 75x + 125$$
 $f^{-1}(x) = x^3 + 15x^2 + 75x + 125$