

12-13 Write a polynomial function in factored form.

12. -5 and $2i$

$$y = (x + 5)(x + 2i)(x - 2i)$$

13. $-3i$, -8 and 7

$$y = (x - 7)(x + 8)(x - 3i)(x + 3i)$$

14-15 List ALL the POSSIBLE rational roots of each polynomial.

14. $f(x) = 5x^3 - x^2 - 32x - 27$

$$\pm \frac{1, 27, 3, 9}{1, 5} = \boxed{\pm 1, \pm 27, \pm 3, \pm 9, \pm \frac{1}{5}, \pm \frac{27}{5}, \pm \frac{3}{5}, \pm \frac{9}{5}}$$

15. $f(x) = 2x^4 + 13x^2 + 7x - 12$

$$\pm \frac{1, 2, 6, 3, 4, 12}{1, 2} = \boxed{\pm 1, \pm 2, \pm 6, \pm 3, \pm 4, \pm 12, \pm \frac{1}{2}, \pm \frac{3}{2}}$$

16-17. Factor the polynomials.

16. $x^4 - 16$

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

$$\boxed{(x^2 + 4)(x - 2)(x + 2)}$$

17. $x^4 - 8x^3 + 12x^2$

$$x^2(x^2 - 8x + 12)$$

$$\boxed{x^2(x - 6)(x - 2)}$$

18-21, Solve each equation. Give exact answers, and state any multiplicity.

18. $x^3 - 2x^2 - 5x + 6 = 0$

$$\begin{array}{r|rrrr} -2 & 1 & -2 & -5 & 6 \\ & \downarrow & -2 & 8 & -6 \\ \hline & 1 & -4 & 3 & 0 \\ & x^2 & x & c & r \end{array}$$

$$x^2 - 4x + 3 = 0$$

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

$$\begin{array}{l} \downarrow \\ x - 1 = 0 \\ +1 +1 \\ \boxed{x = 1} \end{array}$$

$$\begin{array}{l} \downarrow \\ x - 3 = 0 \\ +3 +3 \\ \boxed{x = 3} \end{array}$$

$$\boxed{x = -2}$$

19. $6x^2 = x^4 - x^3$

$$x^4 - x^3 - 6x^2 = 0$$

$$x^2(x^2 - x - 6) = 0$$

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

\circ mult of 2

$$\begin{array}{l} \downarrow \\ x - 3 = 0 \\ \boxed{x = 3} \end{array}$$

$$\begin{array}{l} \downarrow \\ x + 2 = 0 \\ \boxed{x = -2} \end{array}$$

20. $x^4 - 8x^2 = 9$

$$x^4 - 8x^2 - 9 = 0$$

$$(x^2 - 9)(x^2 + 1) = 0$$

$$x^2 - 9 = 0$$

$$\frac{+9 \quad +9}{x^2 = 9}$$

$$\sqrt{x^2} = \sqrt{9}$$

$$x = \pm 3$$

$$x^2 + 1 = 0$$

$$\frac{-1 \quad -1}{x^2 = -1}$$

$$\sqrt{x^2} = \sqrt{-1}$$

$$x = \pm i$$

(Solve.)

21. $x^3 - x^2 - 8x = -8$

$$x^3 - x^2 - 8x + 8 = 0$$

$$\begin{array}{r|rrrr} 1 & 1 & -1 & -8 & 8 \\ & \downarrow & & & -8 \\ \hline & 1 & 0 & -8 & 0 \\ x^2 & x & c & R & \end{array}$$

$$x^2 - 8 = 0$$

$$\frac{+8 \quad +8}{x^2 = 8}$$

$$\sqrt{x^2} = \sqrt{8} = \sqrt{4} \cdot \sqrt{2}$$

$$x = \pm 2\sqrt{2}$$

$$x = 1$$

CALCULATOR PART

22. Use your calculator to approximate the coordinates of the zeros, any relative maximums, any relative minimums and determine the end behavior of the following functions.

a. $y = .5x^3 + 3.5x^2 + 2x - 6$

Maximum(s): (-4.36, 10.37)

Minimum(s): (-.31, -6.30)

Zero(s): -6, -2, and 1

End Behavior:

As $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$.

As $x \rightarrow +\infty$, $f(x) \rightarrow \infty$.

b.

$y = .25x^3 - 1.5x^2 + 1.25x + 3$

Maximum(s): (.47, 3.28)

Minimum(s): (3.53, -.28)

Zero(s): -1, 3, and 4

End Behavior:

As $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$.

As $x \rightarrow +\infty$, $f(x) \rightarrow \infty$.