

Factor Theorem

Find all zeros. One zero has been given.

1) $f(x) = x^3 + 4x^2 - 11x - 30$; (-5)

$$\begin{array}{r|rrrr} -5 & 1 & 4 & -11 & -30 \\ & \downarrow & -5 & 5 & 30 \\ \hline & 1 & -1 & -6 & 0 \end{array}$$

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

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

$$x = 3, x = 2, x = -5$$

2) $f(x) = x^3 - 2x^2 - 25x + 50$; (2)

$$\begin{array}{r|rrrr} 2 & 1 & -2 & -25 & 50 \\ & \downarrow & 2 & 0 & -50 \\ \hline & 1 & 0 & -25 & 0 \end{array}$$

$$x^2 + 0x - 25 = 0$$

$$x^2 - 25 = 0$$

$$\sqrt{x^2} = \sqrt{25}$$

$$x = \pm 5, x = 2$$

3) $f(x) = x^3 - 5x^2 - 9x + 45$; (5)

$$\begin{array}{r|rrrr} 5 & 1 & -5 & -9 & 45 \\ & \downarrow & 5 & 0 & -45 \\ \hline & 1 & 0 & -9 & 0 \end{array}$$

$$x^2 + 0x - 9 = 0$$

$$x^2 - 9 = 0$$

$$+9 \quad +9$$

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

$$x = \pm 3, x = 5$$

4) $f(x) = x^3 + 6x^2 + 3x - 10$; (-2)

$$\begin{array}{r|rrrr} -2 & 1 & 6 & 3 & -10 \\ & \downarrow & -2 & -8 & 10 \\ \hline & 1 & 4 & -5 & 0 \end{array}$$

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

$$(x+5)(x-1) = 0$$

$$x = -5, x = 1, x = -2$$

5) $f(x) = x^3 + x^2 - 22x - 40$; (5)

$$\begin{array}{r|rrrr} 5 & 1 & 1 & -22 & -40 \\ & \downarrow & 5 & 30 & 40 \\ \hline & 1 & 6 & 8 & 0 \end{array}$$

$$x^2 + 6x + 8 = 0$$

$$(x+4)(x+2) = 0$$

$$x = -4, x = -2, x = 5$$

6) $f(x) = x^3 + 5x^2 - 9x - 45$; (-3)

$$\begin{array}{r|rrrr} -3 & 1 & 5 & -9 & -45 \\ & \downarrow & -3 & -6 & 45 \\ \hline & 1 & 2 & -15 & 0 \end{array}$$

$$x^2 + 2x - 15 = 0$$

$$(x-3)(x+5) = 0$$

$$x = 3, x = -5, x = -3$$

$$7) f(x) = 2x^3 - x^2 - 7x + 6; -2$$

$$\begin{array}{r|rrrr} -2 & 2 & -1 & -7 & 6 \\ & \downarrow & -4 & 10 & -6 \\ \hline & 2 & -5 & 3 & 0 \end{array}$$

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

$$x^2 - 5x + 6 = 0$$

$$(x - \frac{2}{2})(x - \frac{3}{2}) = 0$$

$$(x - 1)(x - \frac{3}{2}) = 0$$

$$x = 1$$

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

$$x = -2$$

$$9) f(x) = 5x^3 + 13x^2 + 4x - 4; -2$$

$$\begin{array}{r|rrrr} -2 & 5 & 13 & 4 & -4 \\ & \downarrow & -10 & -6 & 4 \\ \hline & 5 & 3 & -2 & 0 \end{array}$$

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

$$x^2 + 3x - 10 = 0$$

$$(x - \frac{2}{5})(x + 5) = 0$$

$$(x - \frac{2}{5})(x + 1) = 0$$

$$x = \frac{2}{5}, x = -1, x = -2$$

$$11) f(x) = 2x^3 - 21x^2 + 70x - 75; 5$$

$$\begin{array}{r|rrrr} 5 & 2 & -21 & 70 & -75 \\ & \downarrow & 10 & -55 & 75 \\ \hline & 2 & -11 & 15 & 0 \end{array}$$

$$2x^2 - 11x + 15 = 0$$

$$(x - \frac{4}{2})(x - \frac{5}{2}) = 0$$

$$(x - 3)(x - \frac{5}{2}) = 0$$

$$8) f(x) = 3x^3 + 8x^2 - 13x - 30; 2$$

$$\begin{array}{r|rrrr} 2 & 3 & 8 & -13 & -30 \\ & \downarrow & 6 & 28 & 30 \\ \hline & 3 & 14 & 15 & 0 \end{array}$$

$$3x^2 + 14x + 15 = 0$$

$$x^2 + 14x + 45 = 0$$

$$(x + \frac{9}{3})(x + \frac{5}{3}) = 0$$

$$(x + 3)(x + \frac{5}{3}) = 0$$

$$x = -3, x = -\frac{5}{3}, x = 2$$

$$10) f(x) = 5x^3 - 8x^2 - 44x - 16; -2$$

$$\begin{array}{r|rrrr} -2 & 5 & -8 & -44 & -16 \\ & \downarrow & -10 & 36 & 16 \\ \hline & 5 & -18 & -8 & 0 \end{array}$$

$$5x^2 - 18x - 8 = 0$$

$$x^2 - 18x - 40 = 0$$

$$(x - \frac{20}{5})(x + 2) = 0$$

$$(x - 4)(x + \frac{2}{5}) = 0$$

$$x = 4$$

$$x = -\frac{2}{5}$$

$$x = -2$$

$$12) f(x) = 6x^3 + 19x^2 - 45x - 100; 4$$

$$\begin{array}{r|rrrr} -4 & 6 & 19 & -45 & -100 \\ & \downarrow & -24 & 20 & 100 \\ \hline & 6 & -5 & -25 & 0 \end{array}$$

$$6x^2 - 5x - 25 = 0$$

$$(x - \frac{15}{6})(x + \frac{10}{6}) = 0$$

$$(x - \frac{5}{2})(x + \frac{5}{3}) = 0$$

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