3.4

1. a_0
   a_n

   $p = \pm 1, \pm 2, \pm 5, \pm 10$
   $q = \pm 1, \pm 2, \pm 3, \pm 6$

   $\frac{p}{q} = \pm 1, \pm 2, \pm 5, \pm 10$
   $\pm \frac{1}{2}, \pm \frac{5}{2}$
   $\pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{5}{3}, \pm \frac{10}{3}$
   $\pm \frac{1}{6}, \pm \frac{5}{6}$

2. 5, 3, 1
   0

3. True

4. False

16. $P(x) = x^3 - 4x^2 - 19x - 14$

$p = \pm 1, \pm 2, \pm 7, \pm 14$
$q = \pm 1$

$\frac{p}{q} = \pm 1, \pm 2, \pm 7, \pm 14$

$P(1) = 1^3 - 4(1)^2 - 19(1) - 14$
$= 1 - 4 - 19 - 14$
$\neq 0$

$P(-1) = (-1)^3 - 4(-1)^2 - 19(-1) - 14$
$= -1 - 4 + 19 - 14$
$= 0$

$$\begin{array}{r|l} & x^2 - 5x - 14 \\ \hline x+1 & x^3 - 4x^2 - 19x - 14 \\ & \underline{x^3 + x^2} \\ & -5x^2 - 19x \\ & \underline{-5x^2 - 5x} \\ & -14x - 14 \\ & \underline{-14x - 14} \\ & 0 \end{array}$$

$P(x) = (x+1)(x^2 - 5x - 14)$
$P(x) = (x+1)(x-7)(x+2)$
Zeros: $-1, -2, 7$

20. $P(x) = x^3 + 12x^2 + 48x + 64$

$p = \pm 1, \pm 2, \pm 4, \pm 8, \pm 16, \pm 32, \pm 64$
$q = \pm 1$

$\frac{p}{q} = \pm 1, \pm 2, \pm 4, \pm 8, \pm 16, \pm 32, \pm 64$

Note that no value > 0 works.
$P(-1) = -1 + 12 - 48 + 64 \neq 0$
$P(-2) = -8 + 48 - 96 + 64 \neq 0$
$P(-4) = -64 + 192 - 192 + 64 = 0$

20. (Continued)

$$\begin{array}{r|l} & x^2 + 8x + 16 \\ \hline x+4 & x^3 + 12x^2 + 48x + 64 \\ & \underline{x^3 + 4x^2} \\ & 8x^2 + 48x \\ & \underline{8x^2 + 32x} \\ & 16x + 64 \\ & \underline{16x + 64} \\ & 0 \end{array}$$

$P(x) = (x+4)(x^2 + 8x + 16)$
$= (x+4)(x+4)^2$
$P(x) = (x+4)^3$
Zeros: -4

24. $P(x) = x^3 - 4x^2 - 11x + 30$

$p = \pm 1, \pm 2, \pm 5, \pm 6, \pm 10, \pm 15, \pm 30$
$q = \pm 1$

$\frac{p}{q} = \pm 1, \pm 2, \pm 5, \pm 6, \pm 10, \pm 15, \pm 30$

$P(1) = 1 - 4 - 11 + 30 \neq 0$
$P(-1) = -1 - 4 + 11 + 30 \neq 0$
$P(2) = 8 - 16 - 22 + 30 = 0$

$$\begin{array}{r|l} & x^2 - 2x - 15 \\ \hline x-2 & x^3 - 4x^2 - 11x + 30 \\ & \underline{x^3 - 2x^2} \\ & -2x^2 - 11x \\ & \underline{-2x^2 + 4x} \\ & -15x + 30 \\ & \underline{-15x + 30} \\ & 0 \end{array}$$

$P(x) = (x-2)(x^2 - 2x - 15)$
$P(x) = (x-2)(x-5)(x+3)$
Zeros: $-3, 2, 5$

28. $P(x) = x^4 - x^3 - 23x^2 - 3x + 90$

$P(1) = 1 - 1 - 23 - 3 + 90 \neq 0$
$P(-1) = 1 + 1 + 23 + 4 + 90 \neq 0$
$P(2) = 16 - 8 - 92 - 6 + 90 = 0$

$$
\begin{array}{r|l}
 & x^3 + x^2 - 21x - 45 \\
\hline
x - 2 & x^4 - x^3 - 23x^2 - 3x + 90 \\
 & \underline{x^4 - 2x^3} \\
 & \quad x^3 - 23x^2 \\
 & \quad \underline{x^3 - 2x^2} \\
 & \qquad -21x^2 - 3x \\
 & \qquad \underline{-21x^2 + 42x} \\
 & \qquad\quad -45x + 90 \\
 & \qquad\quad \underline{-45x + 90} \\
 & \qquad\qquad 0
\end{array}
$$

$P(x) = (x-2)(x^3 + x^2 - 21x - 45)$

$Q(x) = x^3 + x^2 - 21x - 45$
± 1 already don't work
$Q(3) = 27 + 9 - 63 - 45 \neq 0$
$Q(-3) = -27 + 9 + 63 - 45 = 0$

$$
\begin{array}{r|l}
 & x^2 - 2x - 15 \\
\hline
x + 3 & x^3 + x^2 - 21x - 45 \\
 & \underline{x^3 + 3x^2} \\
 & \quad -2x^2 - 21x \\
 & \quad \underline{-2x^2 - 6x} \\
 & \qquad -15x - 45 \\
 & \qquad \underline{-15x - 45} \\
 & \qquad\qquad 0
\end{array}
$$

$P(x) = (x-2)(x+3)(x^2 - 2x - 15)$
$= (x-2)(x+3)(x-5)(x+3)$
$P(x) = (x+3)^2(x-2)(x-5)$
Zeros: $-3, 2, 5$

32. $P(x) = 2x^3 + 7x^2 + 4x - 4$

$p = \pm 1, \pm 2, \pm 4$
$q = \pm 1, \pm 2$

$\frac{p}{q} = \pm 1, \pm 2, \pm 4, \pm \frac{1}{2}$

$P(1) = 2 + 7 + 4 - 4 \neq 0$
$P(-1) = -2 + 7 - 4 - 4 \neq 0$
$P(2) = 16 + 28 + 8 - 4 \neq 0$
$P(-2) = -16 + 28 - 8 - 4 = 0$

$$
\begin{array}{r|l}
 & 2x^2 + 3x - 2 \\
\hline
x + 2 & 2x^3 + 7x^2 + 4x - 4 \\
 & \underline{2x^3 + 4x^2} \\
 & \quad 3x^2 + 4x \\
 & \quad \underline{3x^2 + 6x} \\
 & \qquad -2x - 4 \\
 & \qquad \underline{-2x - 4} \\
 & \qquad\quad 0
\end{array}
$$

$P(x) = (x+2)(2x^2 + 3x - 2)$
$= (x+2)(2x-1)(x+2)$
$P(x) = (x+2)^2(2x-1)$
Zeros: $-2, \frac{1}{2}$

36. $P(x) = 12x^3 - 25x^2 + x + 2$

$p = \pm 1, \pm 2$
$q = \pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

$P(1) = 12 - 25 + 1 - 2 \neq 0$
$P(-1) = -12 - 25 - 1 - 2 \neq 0$
$P(2) = 96 - 100 + 2 + 2 = 0$

$$
\begin{array}{r|l}
 & 12x^2 - x - 1 \\
\hline
x-2 & 12x^3 - 25x^2 + x + 2 \\
 & \underline{12x^3 - 24x^2} \\
 & \quad -x^2 + x \\
 & \quad \underline{-x^2 + 2x} \\
 & \qquad -x + 2 \\
 & \qquad \underline{-x + 2} \\
 & \qquad\quad 0
\end{array}
$$

$P(x) = (x-2)(12x^2 - x - 1)$
$= 12(x-2)(x^2 - \frac{1}{12}x - \frac{1}{12})$
$= 12(x-2)(x + \frac{1}{4})(x - \frac{1}{3})$
$P(x) = (x-2)(4x+1)(3x-1)$

Tricky! If you use the quadratic formula you will get the correct zeros; however, $(x + \frac{1}{4})(x - \frac{1}{3})$ still need a factor of 12 so that the leading coefficient is $12x^2$.

Zeros: $-\frac{1}{4}, \frac{1}{3}, 2$

40. $P(x) = 6x^4 - 7x^3 - 12x^2 + 3x + 2$

$p = \pm 1, \pm 2$
$q = \pm 1, \pm 2, \pm 3, \pm 6.$

$P(1) = 6 - 7 - 12 + 3 - 2 \neq 0$
$P(-1) = 6 + 7 - 12 - 3 + 2 = 0$

$$
\begin{array}{r|l}
 & 6x^3 - 13x^2 + x + 2 \\
\hline
x+1 & 6x^4 - 7x^3 - 12x^2 + 3x + 2 \\
 & \underline{6x^4 + 6x^3} \\
 & \quad -13x^3 - 12x^2 \\
 & \quad \underline{-13x^3 - 13x^2} \\
 & \qquad x^2 + 3x \\
 & \qquad \underline{x^2 + x} \\
 & \qquad\quad 2x + 2 \\
 & \qquad\quad \underline{2x + 2} \\
 & \qquad\qquad 0
\end{array}
$$

$P(x) = (x+1)(6x^3 - 13x^2 + x + 2)$
$Q(x) = 6x^3 - 13x^2 + x + 2$
$Q(-1) = -6 - 13 - 1 + 2 \neq 0$
$Q(2) = 48 - 52 + 2 + 2 = 0$

$$
\begin{array}{r|l}
 & 6x^2 - x - 1 \\
\hline
x-2 & 6x^3 - 13x^2 + x + 2 \\
 & \underline{6x^3 - 12x^2} \\
 & \quad -x^2 + x \\
 & \quad \underline{-x^2 + 2x} \\
 & \qquad -x + 2 \\
 & \qquad \underline{-x + 2} \\
 & \qquad\quad 0
\end{array}
$$

$P(x) = (x+1)(x-2)(6x^2 - x - 1)$
$x = \frac{1 \pm \sqrt{1+24}}{12} = \frac{1 \pm 5}{12}$
$x = -\frac{1}{3}, \frac{1}{2}$
$P(x) = 6(x+1)(x-2)(x+\frac{1}{3})(x-\frac{1}{2})$
$P(x) = (x+1)(3x+1)(2x-1)(x-2)$
Zeros: $-1, -\frac{1}{3}, \frac{1}{2}, 2$

44. $P(x) = 2x^6 - 3x^5 - 13x^4 + 29x^3 - 27x^2 + 32x - 12$

$p = \pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$
$q = \pm 1, \pm 2$

$P(1) = 2 - 3 - 13 + 29 - 27 + 32 - 12 \neq 0$
$P(-1) = 2 + 3 - 13 - 29 - 27 - 32 - 12 \neq 0$
$P(2) = 128 - 96 - 208 + 232 - 108 + 64 - 12 = 0$

$$
\begin{array}{r|l}
 & 2x^5 + x^4 - 11x^3 + 7x^2 - 13x + 6 \\
\hline
x - 2 & 2x^6 - 3x^5 - 13x^4 + 29x^3 - 27x^2 + 32x - 12 \\
 & \underline{3x^6 - 4x^5} \\
 & x^5 - 13x^4 \\
 & \underline{x^5 - 2x^4} \\
 & -11x^4 + 29x^3 \\
 & \underline{-11x^4 + 22x^3} \\
 & 7x^3 - 27x^2 \\
 & \underline{7x^3 - 14x^2} \\
 & -13x^2 + 32x \\
 & \underline{-13x^2 + 26x} \\
 & 6x - 12 \\
 & \underline{6x - 12} \\
 & 0
\end{array}
$$

$P(x) = (x-2)(2x^5 + x^4 - 11x^3 + 7x^2 - 13x + 6)$
$Q(x) = 2x^5 + x^4 - 11x^3 + 7x^2 - 13x + 6$
$Q(2) = 64 + 16 - 88 + 28 - 26 + 6 = 0$

$$
\begin{array}{r|l}
 & 2x^4 + 5x^3 - x^2 + 5x - 3 \\
\hline
x - 2 & 2x^5 + x^4 - 11x^3 + 7x^2 - 13x + 6 \\
 & \underline{2x^5 - 4x^4} \\
 & 5x^4 - 11x^3 \\
 & \underline{5x^4 - 10x^3} \\
 & -x^3 + 7x^2 \\
 & \underline{-x^3 + 2x^2} \\
 & 5x^2 - 13x \\
 & \underline{5x^2 - 10x} \\
 & -3x + 6 \\
 & \underline{-3x + 6} \\
 & 0
\end{array}
$$

44. (Continued)

$P(x) = (x-2)^2(2x^4+5x^3-x^2+5x-3)$
$Q(x) = 2x^4+5x^3-x^2+5x-3$
$Q(2) = 32+40-4+10-3 \neq 0$
$Q(-2) = 32-40-4-10-3 \neq 0$
$Q(3) = 162+135-9+15-3 \neq 0$
$Q(-3) = 162-135-9-15-3 = 0$

$$
\begin{array}{r|l}
 & 2x^3-x^2+2x-1 \\
\hline
x+3 & 2x^4+5x^3-x^2+5x-3 \\
 & \underline{2x^4+6x^3} \\
 & -x^3-x^2 \\
 & \underline{-x^3-3x^2} \\
 & 2x^2+5x \\
 & \underline{2x^2+6x} \\
 & -x-3 \\
 & \underline{-x-3} \\
 & 0
\end{array}
$$

$P(x) = (x-2)^2(x+3)(2x^3-x^2+2x-1)$
$= (x+3)(x-2)^2[x^2(2x-1)+2x-1]$
$= (x+3)(x-2)^2(x^2+1)(2x-1)$
$P(x) = (x^2+1)(x+3)(2x-1)(x-2)^2$
Zeros: $-3, \frac{1}{2}, 2$

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

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

$$
\begin{array}{r|l}
 & x^3+3x^2+x-2 \\
\hline
x-1 & x^4+2x^3-2x^2-3x+2 \\
 & \underline{x^4-x^3} \\
 & 3x^3-2x^2 \\
 & \underline{3x^3-3x^2} \\
 & x^2-3x \\
 & \underline{x^2-x} \\
 & -2x+2 \\
 & \underline{-2x+2} \\
 & 0
\end{array}
$$

48. (Continued).

$P(x) = (x-1)(x^3+3x^2+x-2)$
$Q(x) = x^3+3x^2+x-2$
$Q(1) = 1+3+1-2 \neq 0$
$Q(-1) = -1+3-1-2 \neq 0$
$Q(2) = 8+12+2-2 \neq 0$
$Q(-2) = -8+12-2-2 = 0$

$$
\begin{array}{r|l}
 & x^2+x-1 \\
\hline
x+2 & x^3+3x^2+x-2 \\
 & \underline{x^3+2x^2} \\
 & x^2+x \\
 & \underline{x^2-2x} \\
 & -x-2 \\
 & \underline{-x-2} \\
 & 0
\end{array}
$$

$P(x) = (x+2)(x-1)(x^2+x-1)$
$x = \frac{-1 \pm \sqrt{1+4}}{2} = \frac{-1 \pm \sqrt{5}}{2}$

$P(x) = (x+2)(x-1)\left[x-\left(\frac{-1-\sqrt{5}}{2}\right)\right]\left[x-\left(\frac{-1+\sqrt{5}}{2}\right)\right]$
Zeros: $-2, 1, \frac{-1 \pm \sqrt{5}}{2}$

52. $P(x) = 3x^3 - 5x^2 - 8x - 2$

$p = \pm 1, \pm 2$
$q = \pm 1, \pm 3$

$P(1) = 3 - 5 - 8 - 2 \neq 0$
$P(-1) = -3 - 5 + 8 - 2 \neq 0$
$P(2) = 24 - 20 - 16 - 2 \neq 0$
$P(-2) = -24 - 20 + 16 - 2 \neq 0$
$P(\frac{1}{3}) = \frac{1}{9} - \frac{5}{9} - \frac{8}{3} - 2 \neq 0$
$P(-\frac{1}{3}) = -\frac{1}{9} - \frac{5}{9} + \frac{8}{3} - 2 = 0$

$$
\begin{array}{r|l}
 & 3x^2 - 6x - 6 \\
\hline
3x+1 & 9x^3 - 15x^2 - 24x - 6 \\
 & \underline{9x^3 + 3x^2} \\
 & \quad -18x^2 - 24x \\
 & \quad \underline{-18x^2 - 6x} \\
 & \qquad -18x - 6 \\
 & \qquad \underline{-18x - 6} \\
 & \qquad\qquad 0
\end{array}
$$

$P(x) = (x - \frac{1}{3})(3x^2 - 6x - 6)$
$P(x) = (3x - 1)(x^2 - 2x - 2)$

$x = \frac{2 \pm \sqrt{4+8}}{2}$
$= \frac{2 \pm 2\sqrt{3}}{2}$
$x = 1 \pm \sqrt{3}$

$P(x) = (3x-1)[x - (1-\sqrt{3})][x - (1+\sqrt{3})]$
Zeros: $-\frac{1}{3}, 1 \pm \sqrt{3}$

56. $P(x) = -x^3 - 2x^2 + 5x + 6$
$= -(x^3 + 2x^2 - 5x - 6)$

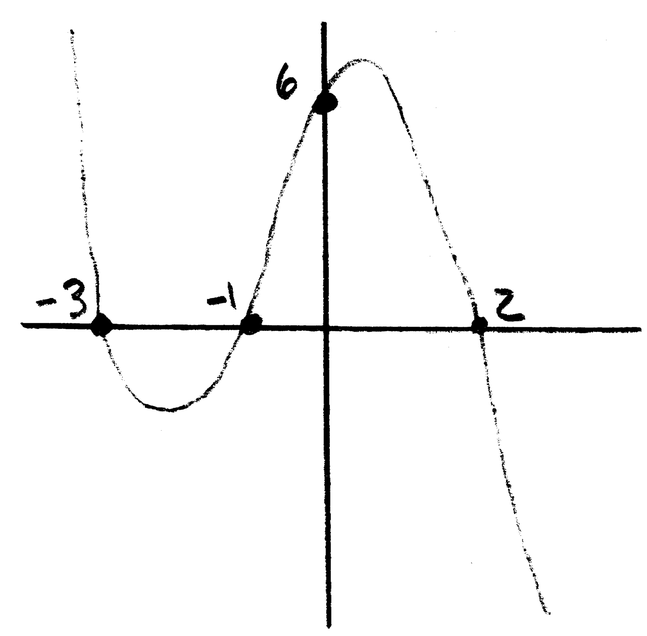
a. $P(1) = -(1 + 2 - 5 - 6) \neq 0$
$P(-1) = -(-1 + 2 + 5 - 6) = 0$

$$
\begin{array}{r|l}
 & x^2 + x - 6 \\
\hline
x+1 & x^3 + 2x^2 - 5x - 6 \\
 & \underline{x^3 + x^2} \\
 & \quad x^2 - 5x \\
 & \quad \underline{x^2 + x} \\
 & \qquad -6x - 6 \\
 & \qquad \underline{-6x - 6} \\
 & \qquad\qquad 0
\end{array}
$$

$P(x) = (x+1)(x^2 + x - 6)$
$P(x) = (x+1)(x+3)(x-2)$
Zeros: $-3, -1, 2$

b. $f(0) = 6$

$P(x) \to -\infty$ as $x \to \infty$
$P(x) \to \infty$ as $x \to -\infty$



58. a. $P(x) = 3x^3 + 17x^2 + 21x - 9$

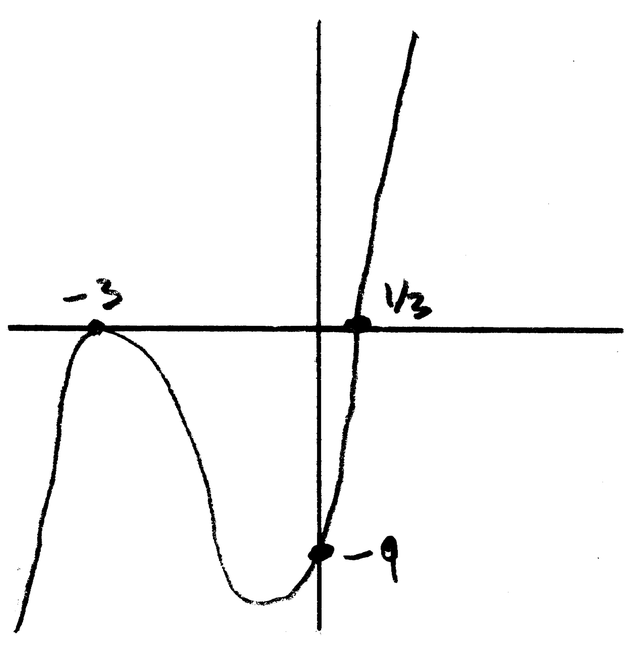
$P(1) = 3 + 17 + 21 - 9 \neq 0$
$P(-1) = -3 + 17 - 21 - 9 \neq 0$
$P(3) = 81 + 153 + 63 - 9 \neq 0$
$P(-3) = -81 + 153 - 63 - 9 = 0$

$$
\begin{array}{r|l}
 & 3x^2 + 8x - 3 \\
\hline
x+3 & 3x^3 + 17x^2 + 21x - 9 \\
 & \underline{3x^3 + 9x^2} \\
 & \quad 8x^2 + 21x \\
 & \quad \underline{8x^2 + 24x} \\
 & \qquad -3x - 9 \\
 & \qquad \underline{-3x - 9} \\
 & \qquad\quad 0
\end{array}
$$

$P(x) = (x+3)(3x^2 + 8x - 3)$
$= (x+3)(3x-1)(x+3)$
$P(x) = (x+3)^2(3x-1)$
zeros: $-3, \frac{1}{3}$

b. $P(0) = -9$

$P(x) \to \infty$ as $x \to \infty$
$P(x) \to -\infty$ as $x \to -\infty$



60. $P(x) = -x^4 + 10x^2 + 8x - 8$
$= -(x^4 - 10x^2 - 8x + 8)$

a. $P(1) = -(1 - 10 - 8 + 8) \neq 0$
$P(-1) = -(1 - 10 + 8 + 8) \neq 0$
$P(2) = -(16 - 40 - 16 + 8) \neq 0$
$P(-2) = -(16 - 40 + 16 + 8) = 0$

$$
\begin{array}{r|l}
 & x^3 - 2x^2 - 6x + 4 \\
\hline
x+2 & x^4 + 0x^3 - 10x^2 - 8x + 8 \\
 & \underline{x^4 + 2x^3} \\
 & \quad -2x^3 - 10x^2 \\
 & \quad \underline{-2x^3 - 4x^2} \\
 & \qquad -6x^2 - 8x \\
 & \qquad \underline{-6x^2 - 12x} \\
 & \qquad\quad 4x + 8 \\
 & \qquad\quad \underline{4x + 8} \\
 & \qquad\qquad 0
\end{array}
$$

$P(x) = -(x+2)(x^3 - 2x^2 - 6x + 4)$
$Q(x) = x^3 - 2x^2 - 6x + 4$
$Q(-2) = -8 - 8 - 12 + 4 = 0$

$$
\begin{array}{r|l}
 & x^2 - 4x + 2 \\
\hline
x+2 & x^3 - 2x^2 - 6x + 4 \\
 & \underline{x^3 + 2x^2} \\
 & \quad -4x^2 - 6x \\
 & \quad \underline{-4x^2 - 8x} \\
 & \qquad 2x + 4 \\
 & \qquad \underline{2x + 4} \\
 & \qquad\quad 0
\end{array}
$$

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

$x = \frac{4 \pm \sqrt{16 - 8}}{2}$
$= \frac{4 \pm 2\sqrt{2}}{2}$
$x = 2 \pm \sqrt{2}$

60. (continued)

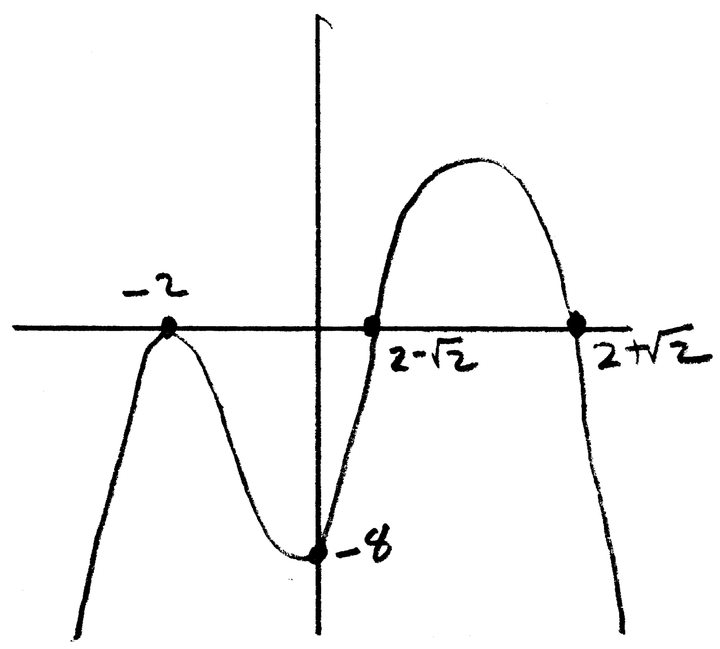
$P(x) = (x+2)^2[x-(2-\sqrt{2})][x-(2+\sqrt{2})]$

Zeroes: $-2,\ 2\pm\sqrt{2}$

b. $P(0) = -8$

$P(x) \to -\infty$ as $x \to \infty$

$P(x) \to -\infty$ as $x \to -\infty$



62. $P(x) = x^5 - x^4 - 6x^3 + 14x^2 - 11x + 3$

a. $P(1) = 1 - 1 - 6 + 14 - 11 + 3 = 0$

$$
\begin{array}{r|l}
 & x^4 - 6x^2 + 8x - 3 \\
\hline
x-1 & x^5 - x^4 - 6x^3 + 14x^2 - 11x + 3 \\
 & \underline{x^5 - x^4} \\
 & 0 - 6x^3 + 14x^2 \\
 & \underline{-6x^3 + 6x^2} \\
 & 8x^2 - 11x \\
 & \underline{8x^2 - 8x} \\
 & -3x + 3 \\
 & \underline{-3x + 3} \\
 & 0
\end{array}
$$

$P(x) = (x-1)(x^4 - 6x^2 + 8x - 3)$

$Q(x) = x^4 - 6x^2 + 8x - 3$

$Q(1) = 1 - 6 + 8 - 3 = 0$

62. (continued)

$$
\begin{array}{r|l}
 & x^3 + x^2 - 5x + 3 \\
\hline
x-1 & x^4 + 0x^3 - 6x^2 + 8x - 3 \\
 & \underline{x^4 - x^3} \\
 & x^3 - 6x^2 \\
 & \underline{x^3 - x^2} \\
 & -5x^2 + 8x \\
 & \underline{-5x^2 + 5x} \\
 & 3x - 3 \\
 & \underline{3x - 3} \\
 & 0
\end{array}
$$

$P(x) = (x-1)^2(x^3 + x^2 - 5x + 3)$

$Q(x) = x^3 + x^2 - 5x + 3$

$Q(1) = 1 + 1 - 5 + 3 = 0$

$$
\begin{array}{r|l}
 & x^2 + 2x - 3 \\
\hline
x-1 & x^3 + x^2 - 5x + 3 \\
 & \underline{x^3 - x^2} \\
 & 2x^2 - 5x \\
 & \underline{2x^2 - 2x} \\
 & -3x + 3 \\
 & \underline{-3x + 3} \\
 & 0
\end{array}
$$

$P(x) = (x-1)^3(x^2 + 2x - 3)$

$= (x-1)^3(x+3)(x-1)$

$P(x) = (x-1)^4(x+3)$

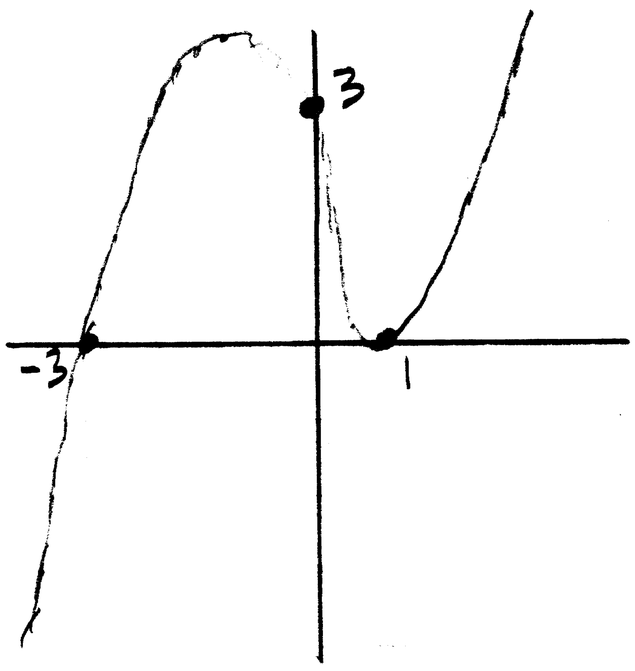
Zeros: $-3,\ 1$

b. $P(0) = 3$

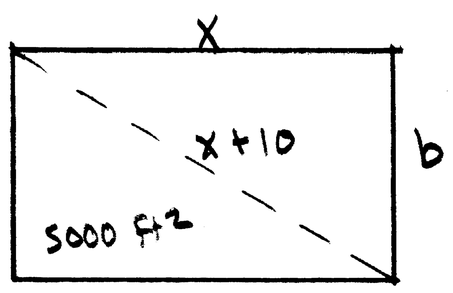
$P(x) \to \infty$ as $x \to \infty$

$P(x) \to -\infty$ as $x \to -\infty$

62. (continued)



100.



$x^2 + b^2 = (x+10)^2$

$b = [(x+10)^2 - x^2]^{1/2}$

$= (\cancel{x^2} + 20x + 100 - \cancel{x^2})^{1/2}$

$b = (20x + 100)^{1/2}$

$A = xb = x(20x+100)^{1/2} = 5000$

$x^2(20x+100) = 5000^2$

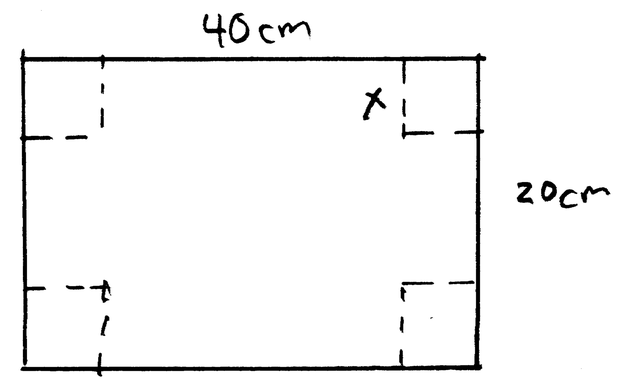
$20x^3 + 100x^2 - 5000^2 = 0$

$x = 106$ ft (calculator)

$b = \frac{5000}{106} = 47$ ft

106 ft x 47 ft

102.



$V = 1500\ cm^3$

$V = x(40-2x)(20-2x) = 1500$

$x(800 - 120x + 4x^2) = 1500$

$4x^3 - 120x^2 + 800x - 1500 = 0$

$x^3 - 30x^2 + 200x - 375 = 0$

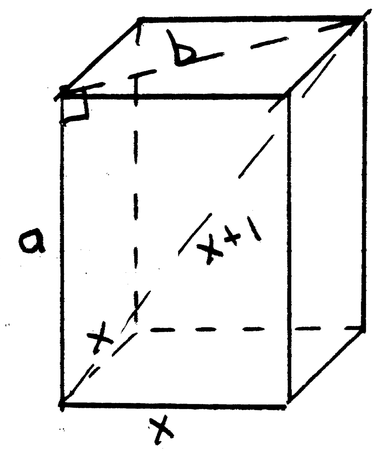
Calculator → $(x-5)\left(x - \frac{25-5\sqrt{13}}{2}\right)\left(x - \frac{25+5\sqrt{13}}{2}\right) = 0$

$x = 5, 3.49, \cancel{27.51}$

5 cm x 10cm x 30cm OR

3.5cm x 13cm x 33cm

104.



$V = 2\sqrt{2} = \sqrt{8}$ ft^3

a. $b^2 = x^2 + x^2$

$b = \sqrt{2}\,x$

$a^2 + b^2 = (x+1)^2$

$a^2 + 2x^2 = x^2 + 2x + 1$

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

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

$V = x^2 a = x^2\sqrt{1+2x-x^2} = \sqrt{8}$

$x^4(1+2x-x^2) = 8$

$x^4 + 2x^5 - x^6 = 8$

$x^6 - 2x^5 - x^4 + 8 = 0$

b. $P(x) = x^6 - 2x^5 - x^4 + 8$

$x = 2.31$ or 1.45 (calculator)

2.31 ft x 2.31 ft x 0.53 ft or

1.45 ft x 1.45 ft x 1.34 ft