

Chapter 2

31 a. $-4 \left| \begin{array}{cccc} 2 & 9 & 3 & -4 \\ \downarrow & -8 & -4 & 4 \\ 2 & 1 & -1 & 0 \end{array} \right. \leftarrow \text{no remainder so } x = -4 \text{ is a solution}$
 $\hookrightarrow 2x^2 + x - 1$

b. $2x^2 + x - 1 = 0$
 $(2x - 1)(x + 1)$

Complete factorization: $(x + 4)(2x - 1)(x + 1)$

c. $(x + 4)(2x - 1)(x + 1) = 0$
 $x = -4, x = \frac{1}{2}, x = -1$

32 $\frac{4 + 2i}{3 - i} \cdot \frac{3 + i}{3 + i} \Rightarrow \frac{12 + 4i + 6i + 2i^2}{9 + 3i - 3i - i^2} = \frac{12 + 10i + 2(-1)}{9 - (-1)} = \frac{12 + 10i - 2}{9 + 1}$
 $= \frac{10 + 10i}{10} = \frac{10}{10} + \frac{10i}{10}$
 $= 1 + i$

33 discriminant: $b^2 - 4ac = (6)^2 - 4(1)(10) = 36 - 40 = -4$
 \uparrow negative discriminant so non-real solution

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{-4}}{2} = \frac{-6 \pm 2i}{2} = \frac{-6}{2} \pm \frac{2i}{2} = -3 \pm i$

$x = -3 + i, x = -3 - i$

34 possible zeros:

$-1 \left| \begin{array}{cccc} 1 & -3 & 9 & 13 \\ \downarrow & -1 & 4 & -13 \\ 1 & -4 & 13 & 0 \end{array} \right. \Rightarrow (x + 1)(x^2 - 4x + 13) = 0$
 $\leftarrow x = -1 \text{ is a solution}$

$x^2 - 4x + 13$: discriminant $= b^2 - 4ac = (-4)^2 - 4(1)(13) = 16 - 52 = -36$
 \uparrow non-real solution

(continued on the next page)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{4 \pm \sqrt{-36}}{2(1)} = \frac{4 \pm 6i}{2} = \frac{4}{2} + \frac{6i}{2} = 2 + 3i$$

$$x = -1, x = 2 + 3i, x = 2 - 3i$$

35) Vertical asymptotes at $x = -2$ and $x = 3$

Horizontal asymptote at $y = -2$

\Rightarrow (d)

domain: $(-\infty, -2) \cup (-2, 3) \cup (3, \infty)$

$$36) f(x) = \frac{(x-2)(x+1)}{(x-2)(x+2)} \Rightarrow \frac{(x+1)}{(x+2)}$$

Vertical asymptote: $x+2=0$

$$x = -2 \Rightarrow \text{(d)}$$

37) Use synthetic division to find slant asymptote

$$\begin{array}{r|rrrr} 9 & 1 & 4 & -3 & \\ & & \downarrow 9 & & \\ & & 1 & 13 & 17 \end{array}$$

slant at $y = x + 13 \Rightarrow$ (b)

38) $f(x) = \frac{5x^2 - 6x - 4}{6x^2 - 7x + 9} \Rightarrow$ since the degree of the num. is the same as the degree of the denom., the HA occurs at $y = 5/6 \Rightarrow$ (b)

39) $f(x) = \frac{x^2 - 5x + 2}{x^2 - 1} \Rightarrow$ H.A. at $y = 1$

$$VA: x^2 - 1 = 0$$

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

$$x = 1, x = -1$$

No slant Asymptote

$$\Rightarrow HA: y = 1$$

$$VA: x = -1, x = 1$$

$$(41) f(x) = \frac{3x+8}{x-9} \Rightarrow \text{HA: } y = \frac{3}{1} \Rightarrow y=3$$

$$\text{VA: } x-9=0$$

$$x=9$$

 \Rightarrow

$$\text{HA: } y=3$$

$$\text{VA: } x=9$$

No slant Asymptote.

$$(42) g(x) = \frac{x+11}{x^2-26x} \Rightarrow \text{HA: } y=0$$

$$\text{VA: } x^2-26x=0$$

$$x(x-26)=0$$

$$x=0, x=26$$

 \Rightarrow

$$\text{HA: } y=0$$

$$\text{VA: } x=0, x=26$$

No slant asymptote.

$$(43) h(x) = \frac{x^2+2x+7}{x+9} \Rightarrow \text{HA: none}$$

$$\text{VA: } x+9=0$$

$$x=-9$$

 \Rightarrow

$$\text{HA: none}$$

$$\text{VA: } x=-9$$

$$\text{Slant: } y=x-7$$

$$\text{Slant: } -9 \mid \begin{array}{ccc} 1 & 2 & 7 \\ \downarrow & -9 & 63 \\ 1 & -7 & 70 \end{array}$$

$$\Rightarrow y=x-7$$

$$(44) \text{ Horiz Asymptote at } y=0 \Rightarrow \text{num} < \text{denom}$$

$$\text{Vert. Asymptote at } x=6 \quad \text{denom: } x-6$$

$$\Rightarrow f(x) = \frac{-6}{x-6} \Rightarrow (b)$$

Reflected

$$(45) k(x) = \frac{x-3}{x^2+x-12} \Rightarrow \frac{x \cancel{3}}{(x+4)(\cancel{x-3})} = \frac{1}{x+4}$$

$$\text{HA: num} < \text{denom: } y=0$$

$$\text{VA: } x+4=0 \Rightarrow x=-4$$

$$\text{Hole: } x-3=0 \Rightarrow x=3 \Rightarrow (3, 1/7)$$

$$y\text{-value: } \frac{1}{3+4} = 1/7$$

$$y\text{-int: } k(0) = \frac{1}{0+4} \Rightarrow \frac{1}{4} \Rightarrow (0, 1/4)$$

$$\text{Domain: } (-\infty, -4) \cup (-4, 3) \cup (3, \infty)$$

$$\text{Range: } (-\infty, 0) \cup (0, 1/7) \cup (1/7, \infty)$$