

Section 4.7B

A polynomial function with rational coefficients has the follow zeros. Find all additional zeros.

1) $2, 1 + 3i$

2) $-2, 1 + 2i$

3) $-3 + i, 1 - 2i$

4) $3, -1 - i, -2 + i$

Find the discriminant of each quadratic equation then state the number and type of solutions.

5) $x^2 + 2x - 1$

6) $3x^2 + 2x + 4$

7) $4x^2 + 12x + 9$

8) $x^2 + 3x + 4$

Solve each equation with the quadratic formula.

9) $2a^2 - 4a + 4 = 0$

10) $n^2 + 2n + 4 = 0$

11) $4b^2 - 2b + 1 = 0$

12) $n^2 + 2n + 5 = 0$

State the possible rational roots for each equation. Then find all roots.

13) $x^3 + 4x^2 - 3x - 12 = 0$

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

15) $x^3 - 2x^2 + 3x - 6 = 0$

16) $x^3 - 4x^2 + 4x - 16 = 0$

17) $x^4 - 4x^3 + x^2 + 16x - 20 = 0$

18) $x^4 - 5x^3 + 7x^2 - 5x + 6 = 0$

19) $x^4 + 3x^2 + 26x - 30 = 0$

20) $x^4 - x^3 - x^2 - x - 2 = 0$

Write a polynomial function of least degree with integral coefficients that has the given zeros.

21) $5, i$

22) $-2, -3i$

23) $-2, -4, i$

24) $3, -3, -i$

25) $-1, 3, -2i$

26) $i, \sqrt{5}$

Match each graph to the given zeros

27) $2i, 3, -4$

28) $1, -1, -3, 4$

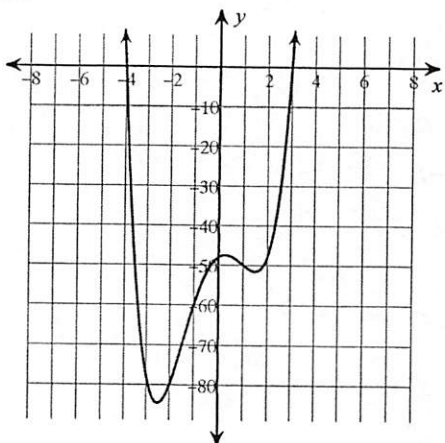
29) $2i, i$

30) $1, -1, 2 - i$

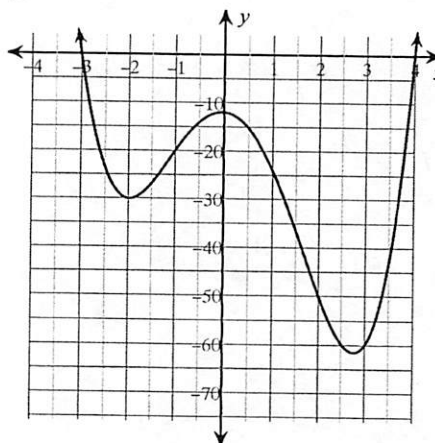
31) $-3, 4, -i$

32) $-3, 1 - i$

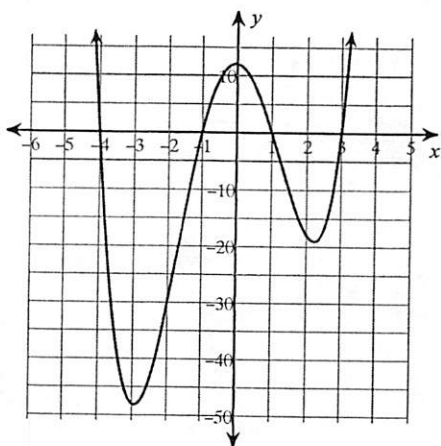
33) A



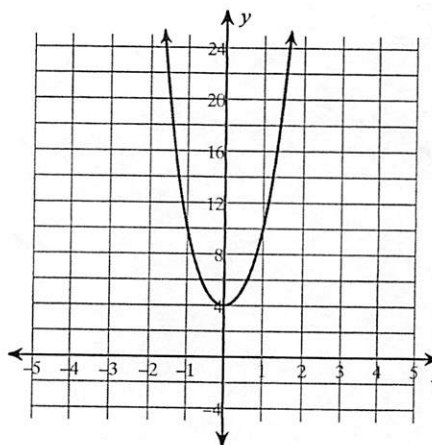
34) B



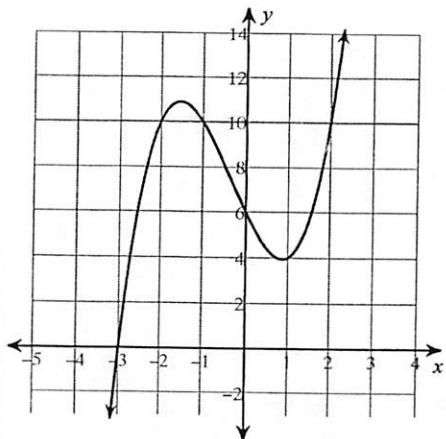
35) C



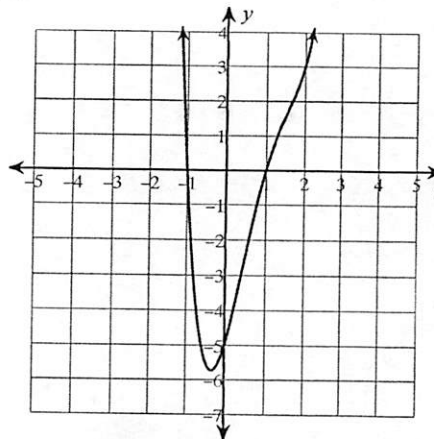
36) D



37) E



38) F



Section 4.7B

A polynomial function with rational coefficients has the follow zeros. Find all additional zeros.

1) 2, $1 + 3i$

$1 - 3i$

2) -2, $1 + 2i$

$1 - 2i$

3) $-3 + i$, $1 - 2i$

$(-3 - i), (1 + 2i)$

$b^2 - 4ac$

4) 3, $-1 - i$, $-2 + i$

$(-1 + i), (-2 - i)$

Find the discriminant of each quadratic equation then state the number and type of solutions.

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

2 IR

6) $3x^2 + 2x + 4$ $4 - 4(3)(4) = -44$

2 Im.

7) $4x^2 + 12x + 9$ $144 - 4(4)(9) = 0$

1 IR

8) $x^2 + 3x + 4$ $9 - 4(1)(4) = -7$

2 Im.

Solve each equation with the quadratic formula.

9) $2a^2 - 4a + 4 = 0$ $\frac{4 \pm \sqrt{16 - 4(2)(4)}}{2(2)}$

$$= \frac{4 \pm \sqrt{-16}}{4} = \frac{4 \pm 4i}{4} = \boxed{1 \pm i}$$

10) $n^2 + 2n + 4 = 0$ $\frac{-2 \pm \sqrt{4 - 4(1)(4)}}{2}$

$$= \frac{-2 \pm \sqrt{-12}}{2} = \frac{-2 \pm 2i\sqrt{3}}{2}$$

$$= \boxed{-1 \pm i\sqrt{3}}$$

11) $4b^2 - 2b + 1 = 0$

$$\frac{2 \pm \sqrt{4 - 4(4)(1)}}{2(4)} = \frac{2 \pm \sqrt{-12}}{8}$$

$$= \frac{2 \pm 2i\sqrt{3}}{8} = \boxed{\frac{1 \pm i\sqrt{3}}{4}}$$

12) $n^2 + 2n + 5 = 0$

$$\frac{-2 \pm \sqrt{4 - 4(1)(5)}}{2(1)}$$

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

$$= \boxed{-1 \pm 2i}$$

State the possible rational roots for each equation. Then find all roots.

13) $x^3 + 4x^2 - 3x - 12 = 0$

Poss: $\pm(1, 2, 3, 4, 6, 12)$

Zeros: -4
 $\pm\sqrt{3}$

$$\begin{array}{r|rrrr} -4 & 1 & 4 & -3 & -12 \\ & & -4 & 0 & 12 \\ \hline & 1 & 0 & -3 & 0 \end{array}$$

$$x^2 - 3$$

$$x = \pm\sqrt{3}$$

15) $x^3 - 2x^2 + 3x - 6 = 0$

Poss: $\pm(1, 2, 3, 6)$

Zeros: $(2, \pm i\sqrt{3})$

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

Poss: $\pm(1, 5)$ Zeros: $-1, 1 \pm 2i$

$$\begin{array}{r|rrrr} -1 & 1 & -1 & 3 & 5 \\ & & -1 & 2 & -5 \\ \hline & 1 & -2 & 5 & 0 \end{array}$$

$$x^2 - 2x + 5$$

$$\frac{2 \pm \sqrt{4 - 4(1)(5)}}{2(1)} = \frac{2 \pm \sqrt{-16}}{2} = \frac{2 \pm 4i}{2}$$

16) $x^3 - 4x^2 + 4x - 16 = 0$

Poss: $\pm(1, 2, 4, 8, 16)$

Zeros: $4, \pm 2i$

17) $x^4 - 4x^3 + x^2 + 16x - 20 = 0$

Poss: $\pm(1, 2, 4, 5, 10, 20)$

Zeros: $\pm 2, 2 \pm i$

18) $x^4 - 5x^3 + 7x^2 - 5x + 6 = 0$

Poss: $\pm(1, 2, 3, 6)$

Zeros: $2, 3, \pm i$

19) $x^4 + 3x^2 + 26x - 30 = 0$

Poss: $\pm(1, 2, 3, 5, 6, 10, 15, 30)$

Zeros: $1, -3, 1 \pm 3i$

20) $x^4 - x^3 - x^2 - x - 2 = 0$

Poss: $\pm(1, 2)$

Zeros: $2, -1, \pm i$

Write a polynomial function of least degree with integral coefficients that has the given zeros.

21) 5, i

$$\begin{aligned} &(x-5)(x+i)(x-i) \\ &(x-5)(x^2+1) \end{aligned}$$

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

22) -2, $-3i$

$$\begin{aligned} &(x+2)(x+3i)(x-3i) \\ &(x+2)(x^2+9) \end{aligned}$$

$$f(x) = x^3 + 2x^2 + 9x + 18$$

23) -2, -4, i

$$\begin{aligned} &(x+2)(x+4)(x+i)(x-i) \\ &(x^2+6x+8)(x^2+1) \end{aligned}$$

$$f(x) = x^4 + 6x^3 + 9x^2 + 6x + 8$$

24) 3, -3, $-i$

$$f(x) = x^4 - 8x^3 - 9$$

25) -1, 3, $-2i$

$$f(x) = x^4 - 2x^3 + x^2 - 8x - 12$$

26) $i, \sqrt{5}$

$$\begin{aligned} &(x+i)(x-i)(x+\sqrt{5})(x-\sqrt{5}) \\ &(x^2+1)(x^2-5) \end{aligned}$$

$$f(x) = x^4 - 4x^2 - 5$$

Match each graph to the given zeros

27) $2i, 3, -4$ **A**

29) $2i, i$ **D**

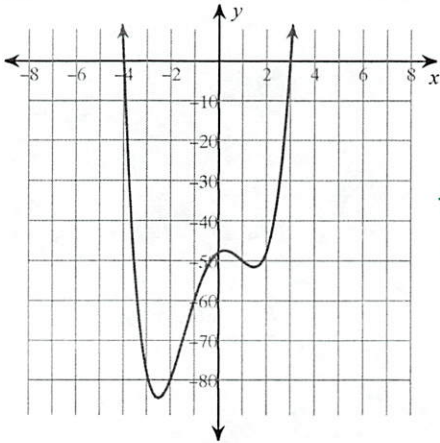
31) $-3, 4, -i$ **B**

28) $1, -1, -3, 4$ **C**

30) $1, -1, 2 - i$ **F**

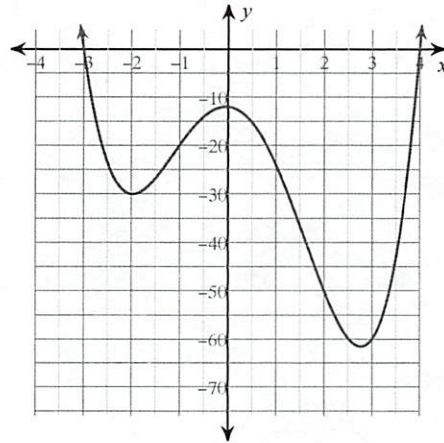
32) $-3, 1 - i$ **E**

33) **A**



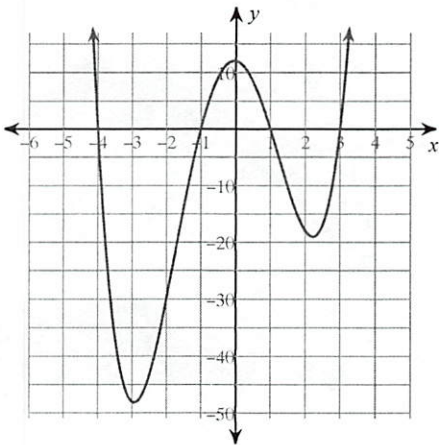
**2 IR
2 I**

34) **B**



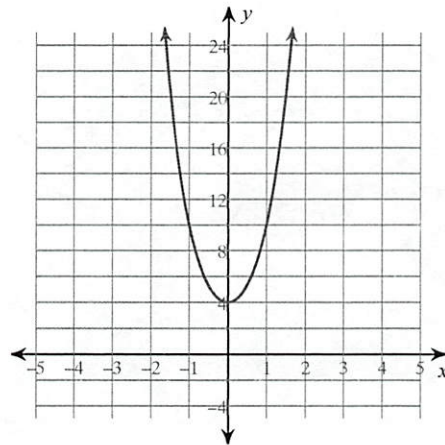
**2 IR
2 I**

35) **C**



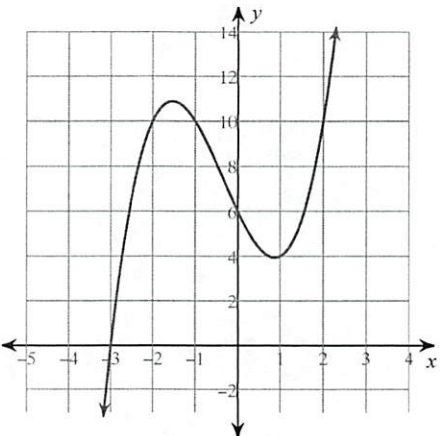
4 IR

36) **D**



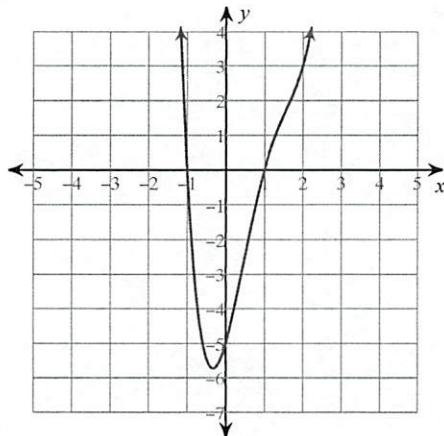
No IR

37) **E**



1 IR

38) **F**



2 IR