

Section 3.2

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③1 Solve the quadratic equation by using the square root property.

(a) $x^2 - 25 = 0$

(b) $x^2 - 17 = 0$

Part-a

$$x^2 - 25 = 0$$

Add 25 to both sides

$$x^2 = 25$$

Take the square root of both sides

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

$$x = \pm 5 \quad (5 \text{ or } -5)$$

Part-b

$$x^2 - 17 = 0$$

Add 17 to both sides

$$x^2 = 17$$

Take the square root of both sides

$$\sqrt{x^2} = \sqrt{17}$$

$$x = \pm\sqrt{17} \quad (\sqrt{17} \text{ or } -\sqrt{17})$$

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③2 Solve the quadratic equation by factoring.

(a) $5x^2 - 2x = 0$

(b) $x^2 + 8x + 7 = 0$

Part-a

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

Factor the left side

$$x(5x - 2) = 0$$

Equate each factor to zero

$$x = 0 \text{ or } 5x - 2 = 0$$

$$x = 0, 2/5$$

Part-b

$$x^2 + 8x + 7 = 0$$

Factor the left side

$$(x + 1)(x + 7) = 0$$

Equate each factor to zero

$$x + 1 = 0 \text{ or } x + 7 = 0$$

$$x = -1, -7$$

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③③ Solve the quadratic equation using the quadratic formula.

(a) $x^2 + 5x + 5 = 0$

(b) $3x^2 + 11x + 10 = 0$

Part-a

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

The coefficients are

$$a = 1, b = 5, \text{ and } c = 5$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (\text{Quadratic formula})$$

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

$$= \frac{-5 \pm \sqrt{5}}{2}$$

$$x = \frac{-5 + \sqrt{5}}{2}, \frac{-5 - \sqrt{5}}{2}$$

Part-b

$$3x^2 + 11x + 10 = 0$$

The coefficients are

$$a = 3, b = 11, \text{ and } c = 10$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad (\text{Quadratic formula})$$

$$= \frac{-11 \pm \sqrt{11^2 - 4(3)(10)}}{2(3)}$$

$$= \frac{-11 \pm 1}{6}$$

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

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③④ Find the domain of the function.

(a) $f(x) = \frac{x+1}{x^2-15}$

(b) $f(x) = \frac{1}{x^2+2x+1}$

Part-a

Solve for the value of x that will make the denominator equal to zero and exclude it from the domain.

$$x^2 - 15 = 0$$

Add 15 to both sides

$$x^2 = 15$$

Take the square root of both sides

$$\sqrt{x^2} = \sqrt{15}$$

$$x = \pm\sqrt{15}$$

Answer:

$$(-\infty, -\sqrt{15}) \cup (-\sqrt{15}, \sqrt{15}) \cup (\sqrt{15}, \infty)$$

Part-b

Solve for the value of x that will make the denominator equal to zero and exclude it from the domain.

$$x^2 + 2x + 1 = 0$$

Factor the left side

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

Take the square root of both sides

$$\sqrt{(x + 1)^2} = \sqrt{0}$$

$$x + 1 = 0$$

$$x = -1$$

$$\text{Answer: } (-\infty, -1) \cup (-1, \infty)$$

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35 Find the x-intercepts of $f(x) = -2x^2 - 8x + 10$ by any method.

$$-2x^2 - 8x + 10 = 0$$

Divide both sides by -2

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

Factor the left side

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

Equate each factor to zero

$$x + 5 = 0 \text{ or } x - 1 = 0$$

$$x = -5, 1$$

Therefore, the x-intercepts are -5 and 1 at the coordinates (-5, 0) and (1, 0)

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36 Simplify by using the imaginary unit i .

(a) $\sqrt{-81}$

(c) $\sqrt{-50}$

(e) $\frac{6 \pm \sqrt{-28}}{12}$

(b) $\sqrt{-11}$

(d) $\sqrt{-6} \cdot \sqrt{-6}$

Use $i = \sqrt{-1}$ and $i^2 = -1$

Part-a

$$\sqrt{-81} = \sqrt{81}\sqrt{-1} = 9i$$

Part-b

$$\sqrt{-11} = \sqrt{11}\sqrt{-1} = \sqrt{11}i \text{ (Note: "i" should be outside the square root sign)}$$

Part-c

$$\sqrt{-50} = \sqrt{25}\sqrt{2}\sqrt{-1} = 5\sqrt{2}i \text{ (Note: "i" should be outside the square root sign)}$$

Part-d

$$\sqrt{-6} \cdot \sqrt{-6} = (\sqrt{6}i)(\sqrt{6}i) = 6i^2 = 6(-1) = -6$$

Part-e

$$\frac{6 \pm \sqrt{-28}}{12} = \frac{6 \pm 2\sqrt{7}i}{12} = \frac{1}{2} \pm \frac{\sqrt{7}}{6}i \text{ (Note: Answer is in the form "a + bi")}$$

#37

(37) Write in standard form. Show your work.

(a) $(-5 + 7i) + (3 - 6i)$

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

(c) $\frac{1 + 3i}{2 + i}$

Part-a

$$\begin{aligned} & (-5 + 7i) + (3 - 6i) \\ &= (-5 + 3) + (7i - 6i) \\ &= -2 + i \end{aligned}$$

Part-b

$$\begin{aligned} & (3 + 2i)(1 - 2i) \\ &= 3 - 6i + 2i - 4i^2 \\ &= 3 - 4i - 4(-1) \\ &= 7 - 4i \end{aligned}$$

Part-c

$$\begin{aligned} & \frac{1 + 3i}{2 + i} \\ &= \frac{1 + 3i}{2 + i} \cdot \frac{2 - i}{2 - i} \quad \text{Multiply the numerator and denominator by the "conjugate" of the denominator} \\ &= \frac{2 - i + 6i - 3i^2}{2^2 - i^2} \\ &= \frac{2 + 5i - 3(-1)}{4 - (-1)} \\ &= \frac{5 + 5i}{5} \\ &= 1 + i \end{aligned}$$

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In Exercises 38-40, determine the imaginary solutions. Write answers in standard form and simplify.

(38) $3x^2 + 24 = 0$

$$3x^2 + 24 = 0$$

Divide both sides by 3

$$x^2 + 8 = 0$$

Subtract 8 from each side

$$x^2 = -8$$

Take the square root of both sides

$$\sqrt{x^2} = \sqrt{-8}$$

$$x = \pm\sqrt{-8}$$

$$x = \pm\sqrt{4} \sqrt{2} \sqrt{-1}$$

$$x = \pm 2\sqrt{2} i \quad (2\sqrt{2} i \text{ or } -2\sqrt{2} i)$$

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$$(39) \quad x^2 - 5x + 7 = 0$$

$$x^2 - 5x + 7 = 0$$

The coefficients are

$$a = 1, b = -5, \text{ and } c = 7$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(7)}}{2(1)} \quad (\text{Quadratic formula})$$

$$= \frac{5 \pm \sqrt{-3}}{2}$$

$$= \frac{5 \pm \sqrt{3} i}{2}$$

$$x = \frac{5}{2} + \frac{\sqrt{3}}{2} i, \quad \frac{5}{2} - \frac{\sqrt{3}}{2} i$$

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$$(40) \quad 2x^2 + 8x + 11 = 0$$

$$2x^2 + 8x + 11 = 0$$

The coefficients are

$$a = 2, b = 8, \text{ and } c = 11$$

$$x = \frac{-8 \pm \sqrt{8^2 - 4(2)(11)}}{2(2)} \quad (\text{Quadratic formula})$$

$$= \frac{-8 \pm \sqrt{-24}}{4}$$

$$= \frac{-8 \pm 2\sqrt{6} i}{4}$$

$$x = -2 + \frac{\sqrt{6}}{2} i, \quad -2 - \frac{\sqrt{6}}{2} i$$