

Learning Target Set A: Simplify an expression containing complex numbers and or radicals.

1-15: Simplify each expression. Circle your final answer.

1. $i + 3 + \sqrt{-4}$
 $i + 3 + 2i$
 $3 + 3i$

2. $(-6 - 12i) - (-8 + 23i)$
 $-6 - 12i + 8 - 23i$
 $2 - 35i$

3. $(7 - 3i)(8 + 4i)$
 $56 + 28i - 24i - 12i^2$
 $56 + 28i - 24i + 12$
 $68 + 4i$

4. $\sqrt{-180} = \sqrt{-1 \cdot 36 \cdot 5}$
 $6i\sqrt{5}$

5. $(\sqrt{-32})(3\sqrt{-48})$
 $(\sqrt{-1 \cdot 16 \cdot 2})(3\sqrt{-1 \cdot 16 \cdot 3})$
 $(4i\sqrt{2})(12i\sqrt{3})$
 $48i^2\sqrt{6}$
 $-48\sqrt{6}$

6. $(3i)(-2i)(5i)$
 $-30i^3$
 $-30(-i)$
 $30i$

$i^1 = i$
 $i^2 = -1$
 $i^3 = -i$
 $i^4 = 1$

7. i^{163}
 $= (i^4)^{40} \cdot i^3$
 $1 \cdot -i = -i$

8. i^{236}
 $= (i^4)^{59} = 1$

9. i^{42}
 $= (i^4)^{10} \cdot i^2$
 $= 1 \cdot -1$
 $= -1$

10. $2i(-8 + 5i)$
 $-16i + 10i^2$
 $-16i - 10$
 $-10 - 16i$

11. $(3 - i)^2$
 $(3 - i)(3 - i)$
 $9 - 3i - 3i + i^2$
 $9 - 6i - 1$
 $8 - 6i$

12. $(10 - 4i) - (7 + 3i)$
 $10 - 4i - 7 - 3i$
 $3 - 7i$

⊗ standard form for complex #: $a + bi$, where a is real and b is imaginary

13. $\frac{(12-i)}{3i} \cdot \frac{i}{i}$
 $= \frac{12i - i^2}{3i^2} = \frac{12i - (-1)}{3(-1)}$
 $= \frac{12i + 1}{-3} = \frac{-1 - 12i}{3}$

14. $\frac{(2+i)}{(2-i)} \cdot \frac{(2+i)}{(2+i)}$
 $= \frac{4 + 2i + 2i + i^2}{4 - i^2}$
 $= \frac{4 - 1 + 4i}{4 - (-1)}$
 $= \frac{3 + 4i}{5}$

15. $\frac{(3-4i)(2-5i)}{(2+5i)(2-5i)}$
 $= \frac{6 - 15i - 8i + 20i^2}{4 - 25i^2}$
 $= \frac{6 - 23i - 20}{4 - 25(-1)}$
 $= \frac{-14 - 23i}{29}$

Learning Target Set B: Solve a quadratic equation over the set of complex numbers using the most efficient method (factoring, square roots/completing the square, or the quadratic formula).

16-27: Solve each quadratic using the most efficient method: factoring, square roots, or the quadratic formula. Circle the final solution. Irrational solutions must be written in simplified radical form (no decimals).

16. $4x^2 + 20 = 0$ (SR)

$$4x^2 = -20$$

$$\sqrt{x^2} = \sqrt{-5}$$

$$x = \pm i\sqrt{5}$$

17. $7x^2 + 6x + 2 = 0$ (QF)

$$x = \frac{-6 \pm \sqrt{36 - 4(7)(2)}}{2(7)}$$

$$x = \frac{-6 \pm \sqrt{-20}}{14}$$

$$x = \frac{-6 \pm 2i\sqrt{5}}{14}$$

$$x = \frac{-3 \pm i\sqrt{5}}{7}$$

Factor pairs: $\begin{matrix} + & \cdot \\ 6 & 4 \\ 2, 42 \\ 2, 21 \\ 3, 14 \\ 6, 7 \\ \text{prime} \end{matrix}$

18. $x^2 - 4x = 13$ (SR/Complete the Square)

$$x^2 - 4x + 4 = 13 + 4$$

$$\sqrt{(x-2)^2} = \sqrt{17}$$

$$x - 2 = \pm \sqrt{17}$$

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

19. $6 = x^2 - x$ (F)

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

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

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

Factor pairs: $\begin{matrix} + & \cdot \\ -1 & -6 \\ 1, 6 \\ 2, 3 \end{matrix}$

20. $x^2 - 2x + 10 = 0$ (SR/Complete the Square)

$$x^2 - 2x + 1 = -10 + 1$$

$$\sqrt{(x-1)^2} = \sqrt{-9}$$

$$x - 1 = \pm 3i$$

$$x = 1 \pm 3i$$

Factor pairs: $\begin{matrix} + & \cdot \\ -2 & 10 \\ 1, 10 \\ 2, 5 \\ \text{prime} \end{matrix}$

21. $3(x+1)^2 + 4 = 22$ (SR)

$$3(x+1)^2 = 18$$

$$\sqrt{(x+1)^2} = \sqrt{6}$$

$$x + 1 = \pm \sqrt{6}$$

$$x = -1 \pm \sqrt{6}$$

22. $3x^2 + 2x - 1 = 0$ (F)

$$3x^2 + 3x - 1x - 1 = 0$$

$$3x(x+1) - 1(x+1) = 0$$

$$(3x-1)(x+1) = 0$$

$$3x-1=0 \quad x+1=0$$

$$x = \frac{1}{3}, x = -1$$

Factor pairs: $\begin{matrix} + & \cdot \\ 2 & -3 \\ -1, 3 \end{matrix}$

23. $\frac{1}{4}x^2 + 1 = 33$ (SR)

$$\frac{1}{4}x^2 = 32 \cdot 4$$

$$\sqrt{x^2} = \sqrt{128}$$

$$x = \pm \sqrt{64 \cdot 2}$$

$$x = \pm 8\sqrt{2}$$

24. $4x^2 - 25 = 0$ (SR) (QR) (F)

$$4x^2 = 25$$

$$\sqrt{x^2} = \sqrt{\frac{25}{4}}$$

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

Factor pairs: $(2x+5)(2x-5) = 0$
 $x = -\frac{5}{2}, x = \frac{5}{2}$

25. $x^2 + 16x - 7 = 0$ (SR)

$$x^2 + 16x + 64 = 7 + 64$$

$$\sqrt{(x+8)^2} = \sqrt{71}$$

$$x + 8 = \pm \sqrt{71}$$

$$x = -8 \pm \sqrt{71}$$

26. $4x^2 + 5x - 6 = 0$ (F)

$$4x^2 + 8x - 3x - 6 = 0$$

$$4x(x+2) - 3(x+2) = 0$$

$$(x+2)(4x-3) = 0$$

$$x = -2, x = \frac{3}{4}$$

Factor pairs: $\begin{matrix} + & \cdot \\ 5 & -24 \\ 1, 24 \\ 2, 12 \\ 3, 8 \\ 4, 6 \end{matrix}$

27. $4x + 4 = x^2$ (SR/Complete the Square)

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

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

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

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

$$x = 2 \pm 2\sqrt{2}$$

Factor pairs: $\begin{matrix} + & \cdot \\ -4 & -4 \\ 1, 4 \\ 2, 2 \end{matrix}$

Learning Target Set C: Write a quadratic equation in any form given a combination of its parts.

28-36: Write a quadratic function in standard form for the information given.

28. roots: $x = \{-8, 7\}$ and has a y-intercept of $(0, -280)$

$$y = a(x+8)(x-7)$$

$$-280 = a(0+8)(0-7)$$

$$-280 = -56a$$

$$a = 5$$

$$y = 5(x+8)(x-7) \star$$

$$y = 5(x^2 + x - 56)$$

$$y = 5x^2 + 5x - 280$$

29. vertex: $(-4, 6)$ and contains the point: $(-1, 9)$

$$y = a(x+4)^2 + 6$$

$$9 = a(-1+4)^2 + 6$$

$$9 = 9a + 6$$

$$3 = 9a$$

$$a = \frac{1}{3}$$

$$y = \frac{1}{3}(x+4)^2 + 6 \star$$

$$y = \frac{1}{3}(x^2 + 8x + 16) + 6$$

$$y = \frac{1}{3}x^2 + \frac{8}{3}x + \frac{16}{3} + 6$$

$$y = \frac{1}{3}x^2 + \frac{8}{3}x + \frac{34}{3}$$

30. x-intercepts: $-1, 6$ and contains the point: $(1, -20)$

$$y = a(x+1)(x-6)$$

$$-20 = a(1+1)(1-6)$$

$$-20 = -10a$$

$$a = 2$$

$$y = 2(x+1)(x-6) \star$$

$$y = 2(x^2 - 5x - 6)$$

$$y = 2x^2 - 10x - 12$$

31. roots: $x = \{\pm 2i\}$ (Let $a=1$)

$$y = (x+2i)(x-2i)$$

$$x^2 - x2i + x2i - 4i^2$$

$$-4(-1)$$

$$y = x^2 + 4$$

32. Max at $(-1, 4)$ and contains the point $(2, -14)$ vertex: $(-1, 4)$ a is neg.

$$y = a(x+1)^2 + 4$$

$$-14 = a(2+1)^2 + 4$$

$$-14 = 9a + 4$$

$$-18 = 9a$$

$$a = -2$$

$$y = -2(x+1)^2 + 4 \star$$

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

$$y = -2x^2 - 4x - 2 + 4$$

$$y = -2x^2 - 4x + 2$$

*33. roots: $x = \{3 \pm 3i\}$ (Let $a=1$)

$$y = (x - (3+3i))(x - (3-3i))$$

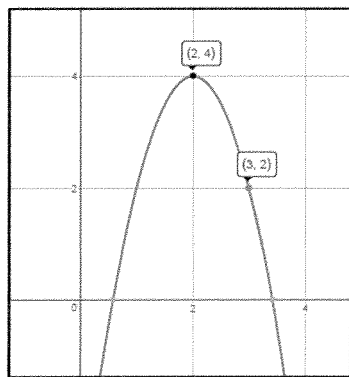
$$= (x-3-3i)(x-3+3i)$$

$$= x^2 - 3x + 3ix - 3x + 9 - 9i^2 - 3ix + 9i^2 - 9i^2$$

$$(+9)$$

$$y = x^2 - 6x + 18$$

34.



$$y = a(x-2)^2 + 4$$

$$2 = a(3-2)^2 + 4$$

$$2 = a + 4$$

$$a = -2$$

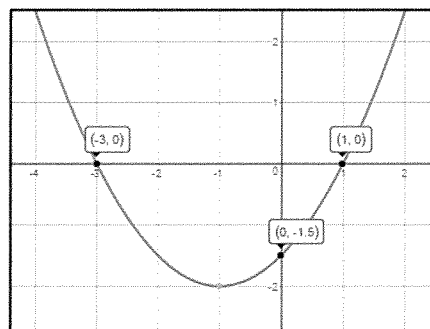
$$y = -2(x-2)^2 + 4$$

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

$$y = -2x^2 + 8x - 8 + 4$$

$$y = -2x^2 + 8x - 4$$

35.



$$y = a(x+3)(x-1)$$

$$-1.5 = a(0+3)(0-1)$$

$$-1.5 = -3a$$

$$0.5 = a$$

$$y = 0.5(x+3)(x-1)$$

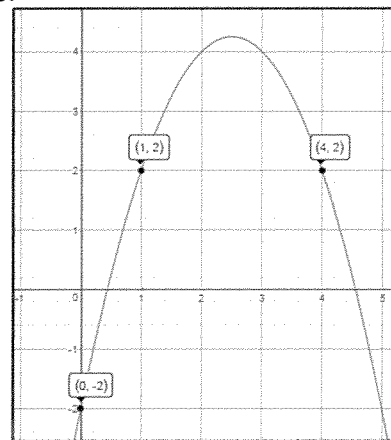
$$y = 0.5(x^2 + 2x - 3)$$

$$y = 0.5x^2 + x - 1.5$$

or

$$y = \frac{1}{2}x^2 + x - \frac{3}{2}$$

36.



on fDc/calc:

① STAT > Edit

x's \rightarrow L1, y's \rightarrow L2

② STAT > CALC > QuadReg

$$y = -x^2 + 5x - 2$$

Learning Target Set D: Solve non-linear systems of equations algebraically and graphically.

37-39: Graph each system below. Then solve it algebraically in the space on the right.

37.

$$y = x^2$$

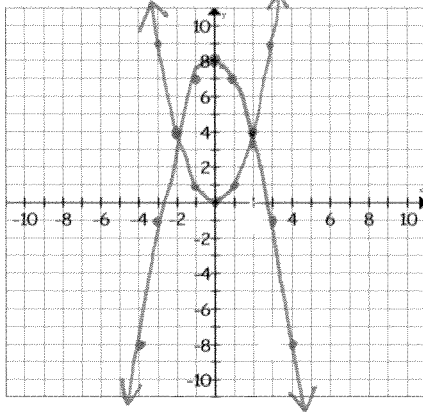
$$y = 8 - x^2$$

$$y = -x^2 + 8$$

vertex
(0, 8)

$$a = -1$$

$$\begin{matrix} (-2, 4) \\ (2, 4) \end{matrix}$$



$$\begin{matrix} y = x^2 \\ y = 8 - x^2 \end{matrix}$$

$$x^2 = 8 - x^2$$

$$2x^2 = 8$$

$$\sqrt{x^2} = \sqrt{4}$$

$$x = \pm 2$$

$$(2, 4) \quad (-2, 4)$$

$$\begin{matrix} x = 2 \\ y = x^2 \\ y = 2^2 \\ y = 4 \end{matrix}$$

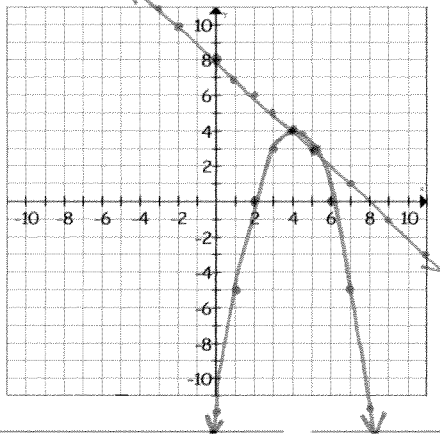
$$\begin{matrix} x = -2 \\ y = x^2 \\ y = (-2)^2 \\ y = 4 \end{matrix}$$

38. $y = -x + 8$

$$x + y = 8$$

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

$$\begin{matrix} (4, 4) \\ (5, 3) \end{matrix}$$



$$\begin{matrix} x + y = 8 \\ y = -(x - 4)^2 + 4 \end{matrix}$$

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

$$-(x^2 - 8x + 16) + 4 = 8$$

$$-x^2 + 8x - 16 + 4 = 8$$

$$x - x^2 + 8x - 12 = 8$$

$$-x^2 + 9x - 20 = 0$$

$$-(x^2 - 9x + 20) = 0$$

$$-(x - 4)(x - 5) = 0$$

$$x = 4, x = 5$$

$$\begin{matrix} x = 4 \\ x + y = 8 \\ 4 + y = 8 \\ y = 4 \end{matrix}$$

$$\begin{matrix} x = 5 \\ x + y = 8 \\ 5 + y = 8 \\ y = 3 \end{matrix}$$

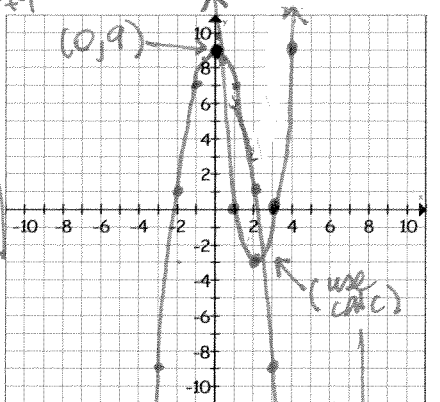
$$\begin{matrix} (4, 4) \\ (5, 3) \end{matrix}$$

39. $y = -2x^2 + 9$

$$-2x^2 = y - 9$$

$$y = 3(x - 2)^2 - 3$$

$$\begin{matrix} (0, 9) \\ (2.4, -2.52) \end{matrix}$$



$$-2x^2 + 9 = 3(x - 2)^2 - 3$$

$$3(x^2 - 4x + 4) - 3$$

$$3x^2 - 12x + 12 - 3$$

$$-2x^2 + 9 = 3x^2 - 12x + 9$$

$$0 = 5x^2 - 12x$$

$$0 = x(5x - 12)$$

$$x = 0 \quad x = \frac{12}{5}$$

$$\begin{matrix} x = 0 \\ y = -2x^2 + 9 \\ y = -2(0) + 9 \\ y = 9 \end{matrix}$$

$$\begin{matrix} x = \frac{12}{5} = 2.4 \\ y = -2\left(\frac{12}{5}\right)^2 + 9 \\ y = -2\left(\frac{144}{25}\right) + 9 \\ y = -\frac{288}{25} + \frac{225}{25} \\ y = \frac{-63}{25} \\ y = -2.52 \end{matrix}$$

$$\begin{matrix} (0, 9) \\ (2.4, -2.52) \end{matrix}$$

Learning Target Set E: Answer the essential questions and related questions regarding the unit.

ESSENTIAL QUESTIONS: Be ready to answer any of these questions using complete sentences!

1. How do the parameters of a function determine the shape of its graph?
2. How do you tell which method to solve quadratic equations is best?
3. Why is it important to learn a variety of methods for solving quadratic equations?
4. What are the zeros of a quadratic function?
5. What real life situations model a quadratic function?
6. Why is it important to know all the forms of a quadratic function?