

LESSON PLAN

Course: Grade 12 U Advanced Functions

Lesson : 1 - 9

Unit/Chapter: Polynomial Skills

Topic: Quadratic Formula

□ *homework check:* **FM12** p. 35 exercise 1.13

□ *note:* **Quadratic Formula**

Use of the quadratic formula relies on your knowledge of how to reduce radicals as well as use of formulas. Recall, to reduce radicals, we need to rely on our knowledge of perfect squares and the imaginary unit “i”. For example,

$$\begin{aligned}\sqrt{32} &= \\ &= \sqrt{16}\sqrt{2} \\ &= 4\sqrt{2}\end{aligned}$$

$$\begin{aligned}-3\sqrt{75} &= \\ &= -3\sqrt{25}\sqrt{3} \\ &= -15\sqrt{3}\end{aligned}$$

$$\begin{aligned}\sqrt{-50} &= \\ &= \sqrt{50}\sqrt{-1} \\ &= \sqrt{25}\sqrt{2}i \\ &= 5\sqrt{2}i\end{aligned}$$

$$\begin{aligned}2\sqrt{-28} &= \\ &= 2\sqrt{4}\sqrt{7}\sqrt{-1} \\ &= 2(2)\sqrt{7}i \\ &= 4\sqrt{7}i\end{aligned}$$

The quadratic formula is linked to the standard form of a quadratic, $Ax^2 + Bx + C$.

Recall the formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. Use of this formula is specific to quadratics that are not factorable.

Solve for x.

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

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

$$x = \frac{-1 \pm \sqrt{1-8}}{4}$$

$$x = \frac{-1 \pm \sqrt{-7}}{4}$$

$$x = \frac{-1 \pm \sqrt{7}i}{4}$$

Remember that division is distributive. For example,

$$\frac{8 \pm 4\sqrt{6}}{4} =$$

$$= \frac{8}{4} \pm \frac{4\sqrt{6}}{4}$$

$$= 2 \pm \sqrt{6}$$

□ **homework assignment:** **FM12** p. 38 exercise 1.14 # 3 & 5 plus handout

Reducing Radicals

Simplify.

1. $\sqrt{72} =$

2. $\sqrt{300} =$

3. $\sqrt{125} =$

4. $\sqrt{8} =$

5. $-2\sqrt{24} =$

6. $5\sqrt{40} =$

7. $-\sqrt{12} =$

8. $3\sqrt{18} =$

9. $5\sqrt{44} =$

10. $-4\sqrt{375} =$

Simplify.

1. $\sqrt{-25} =$

2. $\sqrt{-27} =$

3. $\sqrt{-288} =$

4. $\sqrt{-99} =$

5. $2\sqrt{-45} =$

6. $-3\sqrt{150} =$

7. $5\sqrt{-32} =$

8. $3\sqrt{-147} =$

9. $-7\sqrt{-243} =$

10. $-2\sqrt{-108} =$

Simplify.

1. $\frac{4+\sqrt{24}}{2} =$

2. $\frac{12+2\sqrt{8}}{4} =$

3. $\frac{10-3\sqrt{75}}{5} =$

4. $\frac{8+4\sqrt{28}}{8} =$

5. $\frac{15-2\sqrt{27}}{6} =$

6. $\frac{20+5\sqrt{20}}{10} =$

EXERCISE 1.14

3. Solve.

(a) $3x^2 + 7x + 3 = 0$

(b) $t^2 + 6t + 4 = 0$

(c) $4y^2 + 7 = 12y$

(d) $2x^2 = 6x - 1$

(e) $3m^2 - 7m = 0$

(f) $2x^2 - 11 = 0$

(g) $0 = 2x^2 + 3x + 3$

(h) $6m^2 - m - 12 = 0$

(i) $t^2 + 3t = 1$

(j) $3w^2 = 3w + 1$

5. Solve.

(a) $x^2 + \frac{x}{6} - \frac{1}{6} = 0$

(b) $\frac{3m^2}{2} + \frac{m}{2} - 3 = 0$

(c) $\frac{w^2}{3} - \frac{1}{2} = \frac{w}{3}$

(d) $2x(x + 2) - 3(1 - x) = 0$

(e) $(y + 2)^2 + 7(y + 2) - 3 = 0$

(f) $x^2 - \sqrt{5}x - 1 = 0$

(g) $4.7x^2 - 2.8x - 2 = 0$

(h) $6.3x^2 - 2.7 = 0$

(i) $x^2 - 7.5x + 3.2 = 0$

EXERCISE 1.11

- (a) $(x - 3)(x^2 + 3x + 9)$
 (c) $(m - 2)(m^2 + 2m + 4)$
 $(2x - 1)(4x^2 + 2x + 1)$
 (g) $(3x + 2y)(9x^2 - 6xy + 4y^2)$
 (i) $(s^2 - 3t^3)(s^4 + 3t^3 + 9t^6)$
 (k) $(ab + 3c)(a^2b^2 - 3abc + 9c^2)$
 (m) $\left(\frac{x}{2} - 1\right)\left(\frac{x^2}{4} + \frac{x}{2} + 1\right)$

(a) no
 yes

- (b) $(x + 4)(x^2 - 4x + 16)$
 (d) $(y + 5)(y^2 - 5y + 25)$
 (f) $(4m - 1)(16m^2 + 4m + 1)$
 (h) $(x^2 + y^3)(x^4 - x^2y^3 + y^6)$
 (j) $(10x^4 + y^5)(100x^3 - 10x^4y^5 + y^{10})$
 (l) $(xy^2 - \sqrt[3]{9z^3})(x^2y^4 + \sqrt[3]{9xy^2z^3} + \sqrt[3]{81z^6})$
 (n) $\left(m^2 - \frac{n}{3}\right)\left(m^4 + \frac{m^2n}{3} + \frac{n^2}{9}\right)$

EXERCISE 1.12

- (a) 16 (b) 13 (c) 38
 (a) $2]x - 3]x + 5; 7$
 (c) $4]x - 2]x + 4]x + 1; 33$
 (e) $2]x - 2]x - 3]x + 11; 13$
 (a) $-2]x + 4]x + 3; -3$
 (c) $-1]x - 2]x + 2]x + 9; -30$
 (e) $-1]x - 1]x - 1]x - 1; -40$
 (a) $2]x - 3]x - 4]x + 5]x + 2; 278$
 (c) $-2]x - 3]x + 4]x - 1]x - 3; -647$
 (a) $3]x - 4]x - 5]x - 1; -31$
 (c) $-1]x - 2]x + 3]x + 9; 3$
 (e) $-5]x - 2]x + 4]x - 3]x + 18; -24$

- (d) 25
 (b) $3]x + 7]x - 5]x - 8; 34$
 (d) $1]x - 1]x - 5]x + 6; 0$
 (b) $-3]x + 1]x - 5]x + 10; -77$
 (d) $-4]x + 3]x - 1]x + 4; -80$
 (b) $3]x + 2]x + 1]x - 3]x + 8; 908$
 (d) $-1]x - 2]x + 3]x - 1]x + 12; -328$
 (b) $-2]x + 5]x - 1]x + 7; 45$
 (d) $2]x + 1]x - 3]x - 4]x - 11; 9$

EXERCISE 1.13

- (a) $x = 3$ or $x = 4$ (b) $m = -3$ or $m = -2$ (c) $t = -9$ or $t = 2$
 (d) $y = 1$ or $y = -1$ (e) $m = \frac{1}{2}$ or $m = -5$ (f) $x = -\frac{7}{4}$ or $x = \frac{1}{3}$
 (a) -1 and -2 (b) -2 and 1 (c) -5 and 7 (d) -4 and -6
 (a) $(x + 3)(x - 2) = 0; x = -3$ or $x = 2$ (b) $(y + 3)(y + 4) = 0; y = -3$ or $y = -4$
 (c) $(t + 2)(t - 8) = 0; t = -2$ or $t = 8$ (d) $(w + 2)(w - 2) = 0; w = -2$ or $w = 2$
 (e) $(x + 5)(x + 8) = 0; x = -5$ or $x = -8$ (f) $(m + 2)(m - 7) = 0; m = -2$ or $m = 7$
 (g) $(x + 9)(x - 3) = 0; x = -9$ or $x = 3$ (h) $(m + 5)(m - 5) = 0; m = -5$ or $m = 5$
 (i) $(x - 4)^2 = 0; x = 4$ (j) $(t + 5)^2 = 0; t = -5$
 (a) $x = 3$ or $x = -\frac{5}{3}$ (b) $x = -\frac{1}{2}$ or $x = -\frac{2}{3}$ (c) $m = -\frac{4}{3}$ or $m = \frac{4}{3}$ (d) $y = \frac{1}{4}$ or $y = -\frac{1}{2}$
 (e) $w = -5$ or $w = \frac{1}{2}$ (f) $x = -6$ or $x = 2$ (g) $y = -3$
 (a) $t = 3$ or $t = -\frac{1}{4}$ (b) $x = 0$ or $x = \frac{5}{3}$ (c) $m = \frac{2}{3}$ or $m = -5$ (d) $t = \frac{3}{2}$
 (e) $y = \frac{5}{3}$ or $y = -3$ (f) $m = 0$ or $m = \frac{5}{2}$ (g) $n = -\frac{1}{3}$ or $n = \frac{1}{3}$
 (a) $t = 2$ or $t = 5$ (b) $x = \frac{3}{5}$ or $x = -7$ (c) $t = -4$ or $t = 4$ (d) $x = 2$
 (e) no solutions (f) $x = 1$ or $x = 7$ (g) $x = -3, x = 6$

EXERCISE 1.14

- (a) $a = 1, b = 3, c = 7$ (b) $a = 6, b = 8, c = -1$
 (c) $a = 4, b = -3, c = -9$ (d) $a = 2, b = -1, c = 11$
 (e) $a = 5, b = -1, c = -12$ (f) $a = 1, b = 1, c = 0$
 (g) $a = 1, b = 0, c = -16$ (h) $a = 2, b = -4, c = -9$
 (a) $y = 6$ or $y = -5$ (b) $t = -\frac{4}{3}$ or $t = 1$ (c) $m = -\frac{5}{3}$ or $m = 4$ (d) $x = -\frac{1}{4}$ or $x = 3$
 (e) $m = 1$ or $m = \frac{5}{4}$ (f) $x = \frac{7}{3}$ or $x = -4$ (g) $t = -\frac{5}{2}$ or $t = 3$ (h) $r = \frac{5}{3}$ or $r = -\frac{3}{2}$

- (i) $m = 0$ or $m = 4$ (j) $x = \frac{5}{3}$ or $x = -\frac{3}{2}$
3. (a) $\frac{-7 \pm \sqrt{13}}{6}$ (b) $-3 \pm \sqrt{5}$ (c) $\frac{3 \pm \sqrt{2}}{2}$ (d) $\frac{3 \pm \sqrt{7}}{2}$
 (e) $m = 0$ or $m = \frac{7}{3}$ (f) $\frac{\pm\sqrt{22}}{2}$ (g) $\frac{-3 \pm \sqrt{15}i}{4}$ (h) $m = -\frac{4}{3}$ or $m = \frac{3}{2}$
 (i) $\frac{-3 \pm \sqrt{5}}{2}$ (j) $\frac{3 \pm \sqrt{21}}{3}$
4. (a) $x = 1.16$ or -5.16 (b) $t = -0.38$ or -2.62 (c) $m = 3.24$ or -1.24
 (d) $x = -0.68$ or -7.32 (e) $x = 0.29$ or -2.29 (f) $m = 0.61$ or -0.47
 (g) $x = 0.29$ or -0.69 (h) $y = 5.85$ or -0.85 (i) $m = 0.28$ or -1.78
 (j) $x = 0.62$ or -1.62
5. (a) $x = -\frac{1}{2}$ or $\frac{1}{3}$ (b) $\frac{-1 \pm \sqrt{73}}{6}$ (c) $\frac{1 \pm \sqrt{7}}{2}$ (d) $\frac{-7 \pm \sqrt{73}}{4}$ (e) $\frac{-11 \pm \sqrt{61}}{2}$
 (f) $\frac{3 \pm \sqrt{5}}{2}$ (g) $\frac{14 \pm 4\sqrt{71}}{47}$ (h) $\frac{\pm\sqrt{21}}{7}$ (i) $\frac{75 \pm \sqrt{4345}}{20}$
6. (a) $\frac{1 \pm \sqrt{17}}{14}$ (b) $1 \pm \sqrt{5}$ (c) $-2 \pm \sqrt{2}$ (d) 0 or 6 (e) $\frac{3 \pm \sqrt{129}}{4}$ (f) ± 9
7. (a) $x = \frac{-m \pm \sqrt{m^2 + 4i}}{2}$ (b) $x = \pm \sqrt{q}$ (c) $x = \frac{-e}{d}$ (d) $x = \frac{\pm\sqrt{rs}}{r}$
8. (a) $6, -\frac{2}{7}$ (b) $\frac{3}{2}, 5$ (c) $\frac{2 \pm \sqrt{58}}{3}$ (d) $0.1, -0.15$ (e) $\sqrt{6}, -\frac{\sqrt{6}}{3}$

EXERCISE 1.15

1. (a) $7 + 3i$ (b) 4 (c) 7 (d) $5 - 6i$ (e) $21 - 4i$
 2. (a) $3i$ (b) $12i$ (c) $2i$ (d) $5i$ (e) -7
 (f) $2i$ (g) 7 (h) $10i$ (i) 0 (j) 1
 3. (a) 5 (b) 2 (c) $11 + 7i$ (d) $16 + 11i$ (e) $19 + 9i$
 (f) $22 + 4i$ (g) 29
4. (a) $\frac{3}{2} \pm \frac{\sqrt{7}}{2}i$ (b) $-\frac{1}{6} \pm \frac{\sqrt{47}}{6}i$

EXERCISE 1.16

1. (a) $x = -2$ or 2 or 3 (b) $x = -1$ or 2 or 3 (c) $t = -2$ or $t = 5$
 (d) $w = -1$ or $-\frac{1}{3}$ or 1 (e) $z = -3$ or $\frac{3}{2}$ or 2 (f) $t = -2$ or $\frac{3}{4}$ or 3
 (g) $x = -\frac{3}{2}$ or 1 or 5 (h) $x = -4$ or 3 or 4
2. (a) $x = 2$, or $-1 \pm \sqrt{2}$ (b) $t = -1$ or $\frac{3 \pm \sqrt{5}}{2}$ (c) $w = -2$ or $1 \pm \sqrt{2}i$
 (d) $x = 1$ or $\frac{-1 \pm \sqrt{3}i}{2}$ (e) $t = -2$ or $1 \pm \sqrt{3}i$ (f) $x = -3$ or $\frac{1 \pm \sqrt{21}}{2}$
3. (a) $x = -1$ or 2 or ± 3 (b) $x = -3$ or 4 or ± 1
 (c) $x = \pm 1$ or $\pm i$ (d) $t = -3$ or $-\frac{2}{3}$ or $\frac{5}{2}$
4. (a) $x = 0$ or 3 or $\frac{-3 \pm 3\sqrt{3}i}{2}$ (b) $x = -2$ or $x = 3$
5. (a) $x^2 - 12x + 35 = 0$ (b) $x^3 - 6x^2 + 5x + 12 = 0$
 (c) $x^3 - 9x^2 + 8x + 60 = 0$ (d) $x^3 + 9x^2 + 23x + 15 = 0$
 (e) $x^3 - 4x^2 + 3x + 2 = 0$
6. (a) $x = -3$ or ± 2 (b) $x = -3$ or ± 1 or ± 2 (c) $\frac{1}{3}, \pm\sqrt{2}$
 (d) $\frac{1}{2}, 1 \pm \sqrt{2}$ (e) $-1, 2, -1 \pm i\sqrt{2}$ (f) $-\frac{1}{3}, 3, \frac{-1 \pm i\sqrt{7}}{2}$
7. (a) $x^2 - 2x - 1 = 0$ (b) $x^2 - 4x - 3 = 0$ (c) $x^2 - 2x + 10 = 0$ (d) $x^2 - 4x + 40 = 0$