Name: _____ Date: _____

Learning Goal 4.1	Given a quadratic equation, identify the number of solutions, zeros, roots or $x-$ intercepts.
Learning Goal 4.2	Given a quadratic equation, find the values of solution(s) by factoring, completing the square or using the quadratic formula.

1. Use the discriminant to determine the nature of the roots for each quadratic equation, then solve. Express exact answers.

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

Discriminant Check:

$$\begin{aligned} b^2 - 4ac &= (-5)^2 - 4(1)(4) \\ &= 25 - 16 \\ &= 9 \geq 0 \end{aligned}$$ ✓

$$\begin{aligned} x &= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(4)}}{2(1)} \\ &= \frac{5 \pm \sqrt{25-16}}{2} \\ &= \frac{5 \pm \sqrt{9}}{2} \\ &= \frac{5 \pm 3}{2} \end{aligned}$$

$$x_1 = \frac{5+3}{2} = \frac{8}{2} = 4 \qquad x_2 = \frac{5-3}{2} = \frac{2}{2} = 1$$

a. $3x^2 + 5x - 2 = 0$

Discriminant Check:

$$\begin{aligned} b^2 - 4ac &= (5)^2 - 4(3)(-2) \\ &= 25 + 24 \\ &= 49 \geq 0 \end{aligned}$$ ✓

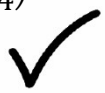
$$\begin{aligned} x &= \frac{-(5) \pm \sqrt{(5)^2 - 4(3)(-2)}}{2(3)} \\ &= \frac{-5 \pm \sqrt{25+24}}{6} \\ &= \frac{-5 \pm \sqrt{49}}{6} \\ &= \frac{-5 \pm 7}{6} \end{aligned}$$

$$x_1 = \frac{-5+7}{6} = \frac{2}{6} = \frac{1}{3} \qquad x_2 = \frac{-5-7}{6} = \frac{-12}{6} = -2$$

b. $\frac{1}{4}x^2 - 3x + 9 = 0$

Discriminant Check:

$$b^2 - 4ac = (-3)^2 - 4\left(\frac{1}{4}\right)(9)$$
$$= 9 - 9$$
$$= 0 \geq 0$$



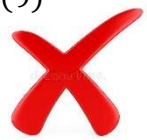
$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4\left(\frac{1}{4}\right)(9)}}{2\left(\frac{1}{4}\right)}$$
$$= \frac{3 \pm \sqrt{9-9}}{\frac{1}{2}}$$
$$= 2(3 \pm \sqrt{0})$$
$$= 2(3)$$
$$= 6$$

c. $2x^2 - 8x = -9$

$$2x^2 - 8x + 9 = 0$$

Discriminant Check:

$$b^2 - 4ac = (-8)^2 - 4(2)(9)$$
$$= 64 - 72$$
$$= -8 \leq 0$$



No **real** roots

2. Solve $4n^2 + 11n - 15 = 0$ by factoring, completing the square and by the quadratic formula.

Factoring	Completing the Square	Quadratic Formula
$-4 \times 15 = -60$ $-4 + 15 = 11$ $4n^2 - 4n + 15n - 15 = 0$ $4n(n-1) + 15(n-1) = 0$ $(n-1)(4n+15) = 0$ $n - 1 = 0$ $\quad 4n + 15 = 0$ $= 1$ $\quad 4n = -15$ $n = -\frac{15}{4}$	$4\left(n^2 + \frac{11}{4}n + \frac{121}{64} - \frac{121}{64}\right) - 15 = 0$ $4\left(n^2 + \frac{11}{4}n + \frac{121}{64}\right) - \frac{121}{16} - 15 = 0$ $4\left(n + \frac{11}{8}\right)^2 - \frac{121}{16} - \frac{240}{16} = 0$ $4\left(n + \frac{11}{8}\right)^2 - \frac{361}{16} = 0$ $4\left(n + \frac{11}{8}\right)^2 = \frac{361}{16}$ $\left(n + \frac{11}{8}\right)^2 = \frac{361}{64}$ $n + \frac{11}{8} = \pm\sqrt{\frac{361}{64}}$ $n + \frac{11}{8} = \pm\frac{19}{8}$ $n = -\frac{11}{8} \pm \frac{19}{8}$ $n = \frac{8}{8}(= 1), -\frac{30}{8}\left(= -\frac{15}{4}\right)$	$n = \frac{-(11) \pm \sqrt{(11)^2 - 4(4)(-15)}}{2(4)}$ $n = \frac{-11 \pm \sqrt{121 + 240}}{8}$ $n = \frac{-11 \pm \sqrt{361}}{8}$ $n = \frac{-11 \pm 19}{8}$ $n = \frac{8}{8}$ $\quad n = -\frac{30}{8}$ $= 1$ $\quad n = -\frac{15}{4}$