

Solving Quadratic Equations

Solve each equation by factoring.

1)  $(a+4)(5a+3)=0$

$a = -4$     $a = -\frac{3}{5}$

3)  $x^2 + 10x + 21 = 0$   
 $(x+7)(x+3) = 0$

$x = -7$     $x = -3$

5)  $n^2 + 6n - 18 = -2$   
 $\quad \quad \quad +2 \quad +2$

$n^2 + 6n - 16 = 0$   
 $(n+8)(n-2) = 0$

$n = -8$     $n = 2$

7)  $x^2 - 9x = -20$   
 $\quad \quad \quad +20 \quad +20$

$x^2 - 9x + 20 = 0$   
 $(x-5)(x-4) = 0$

$x = 5$     $x = 4$

9)  $10n^2 + 13n - 30 = 0$

$10n^2 + 25n - 12n - 30 = 0$   
 $5n(2n+5) - 6(2n+5) = 0$   
 $(5n-6)(2n+5) = 0$

$n = \frac{6}{5}$     $n = -\frac{5}{2}$

11)  $2v^2 - v - 1 = 5$   
 $\quad \quad \quad -5 \quad -5$

$2v^2 - v - 6 = 0$

$2v^2 - 4v + 3v - 6 = 0$

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

$v = -\frac{3}{2}$     $v = 2$

2)  $(k+4)(k-7) = 0$

$k = -4$     $k = 7$

4)  $p^2 + 16p + 64 = 0$   
 $(p+8)(p+8) = 0$

$p = -8$

6)  $m^2 - 8m + 8 = -7$   
 $\quad \quad \quad +7 \quad +7$

$m^2 - 8m + 15 = 0$   
 $(m-5)(m-3) = 0$

$m = 5$     $m = 3$

8)  $r^2 - 24 = -5r$   
 $\quad \quad \quad +5r \quad +5r$

$r^2 + 5r - 24 = 0$   
 $(r+8)(r-3) = 0$

$r = -8$     $r = 3$

10)  $3b^2 - b - 4 = 0$

$3(-4)$   
 $= -12$   
 $-4 \quad +3$

$3b^2 - 4b + 3b - 4 = 0$   
 $b(3b-4) + (3b-4) = 0$   
 $(b+1)(3b-4) = 0$

$b = -1$     $b = \frac{4}{3}$

12)  $4x^2 + 21x + 15 = 4x$   
 $\quad \quad \quad -4x \quad -4x$

$4x^2 + 17x + 15 = 0$

$4x^2 + 12x + 5x + 15 = 0$

$4x(x+3) + 5(x+3) = 0$   
 $(4x+5)(x+3) = 0$

$x = -\frac{5}{4}$     $x = -3$

Solve each equation by taking square roots.

$$13) \begin{array}{r} 64a^2 - 3 = 13 \\ +3 \quad +3 \end{array}$$

$$\frac{64a^2}{64} = \frac{16}{64}$$

$$a^2 = \frac{1}{4}$$

$$a = \pm \sqrt{\frac{1}{4}}$$

$$\rightarrow a = \frac{1}{2}$$

$$\rightarrow a = -\frac{1}{2}$$

$$14) \begin{array}{r} 8x^2 - 10 = 22 \\ +10 \quad +10 \end{array}$$

$$\frac{8x^2}{8} = \frac{32}{8}$$

$$x^2 = 4$$

$$x = \pm \sqrt{4}$$

$$\rightarrow x = 2$$

$$\rightarrow x = -2$$

Solve each equation by completing the square.

$$15) (p^2 - 2p) - 16 = 0$$

$$(p^2 - 2p + 1) - 1 - 16 = 0$$

$$(p^2 - 2p + 1) - 17 = 0$$

$$(p-1)^2 = 17$$

$$p-1 = \pm \sqrt{17}$$

$$p = 1 \pm \sqrt{17}$$

$$\rightarrow p = 1 + \sqrt{17}$$

$$\rightarrow p = 1 - \sqrt{17}$$

$$16) (k^2 - 20k) + 99 = 0$$

$$(k^2 - 20k + 100) - 100 + 99 = 0 \rightarrow \frac{1}{2}(-20) = -10 \rightarrow (-10)^2 = 100$$

$$(k-10)^2 - 1 = 0$$

$$(k-10)^2 = 1$$

$$k-10 = \pm \sqrt{1}$$

$$k = 10 \pm 1$$

$$\rightarrow k = 10 + 1$$

$$\rightarrow k = 10 - 1$$

$$\rightarrow k = 11$$

$$\rightarrow k = 9$$

$$17) \frac{6k^2 - 12k - 18}{6} = \frac{0}{6} \text{ *need coefficient of 1* for } x^2$$

$$(k^2 - 2k) - 3 = 0$$

$$(k^2 - 2k + 1) - 1 - 3 = 0$$

$$(k-1)^2 - 4 = 0$$

$$(k-1)^2 = 4$$

$$k-1 = \pm \sqrt{4}$$

$$k = 1 \pm 2$$

$$\rightarrow k = 1 + 2$$

$$\rightarrow k = 1 - 2$$

$$\rightarrow k = 3$$

$$\rightarrow k = -1$$

$$18) \frac{7n^2 - 14n - 21}{7} = \frac{0}{7}$$

$$(n^2 - 2n) - 3 = 0$$

$$(n^2 - 2n + 1) - 1 - 3 = 0$$

$$(n-1)^2 - 4 = 0$$

$$(n-1)^2 = 4$$

$$n-1 = \pm \sqrt{4}$$

$$n = 1 \pm 2$$

$$\rightarrow n = 3$$

$$\rightarrow n = -1$$

Solve each equation with the quadratic formula.

19)  $5r^2 + 6r - 56 = 0$

$a=5$   $b=6$   $c=-56$

$$x = \frac{-6 \pm \sqrt{b^2 - 4(5)(-56)}}{2(5)}$$

$$x = \frac{-6 \pm \sqrt{1156}}{10}$$

$$x = \frac{-6 \pm 34}{10} \rightarrow \begin{cases} x = \frac{-6 + 34}{10} = \boxed{\frac{14}{5}} \\ x = \frac{-6 - 34}{10} = \boxed{-4} \end{cases}$$

21)  $-4n^2 - 8n + 45 = 0$

$a=-4$   $b=-8$   $c=45$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(-4)(45)}}{2(-4)}$$

$$x = \frac{8 \pm \sqrt{704}}{-8}$$

$$x = \frac{8 \pm 28}{-8} \rightarrow \begin{cases} x = \frac{8 + 28}{-8} = \boxed{-\frac{9}{2}} \\ x = \frac{8 - 28}{-8} = \boxed{\frac{5}{2}} \end{cases}$$

23)  $\frac{-3b^2}{-3} = \frac{-27}{-3}$

$b^2 = 9$

$b = \pm \sqrt{9}$

$b = \pm 3$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

20)  $4m^2 - 2m - 72 = 0$

$a=4$   $b=-2$   $c=-72$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(4)(-72)}}{2(4)}$$

$$x = \frac{2 \pm \sqrt{1156}}{8}$$

$$x = \frac{2 \pm 34}{8} \rightarrow \begin{cases} x = \frac{2 + 34}{8} = \boxed{\frac{9}{2}} \\ x = \frac{2 - 34}{8} = \boxed{-4} \end{cases}$$

22)  $x^2 - 12x - 64 = 0$

$a=1$   $b=-12$   $c=-64$

$$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(1)(-64)}}{2(1)}$$

$$x = \frac{12 \pm \sqrt{400}}{2}$$

$$x = \frac{12 \pm 20}{2} \rightarrow \begin{cases} x = \frac{12 + 20}{2} = \boxed{16} \\ x = \frac{12 - 20}{2} = \boxed{-4} \end{cases}$$

24)  $-4v^2 - 2v = -72$

$+72$   $+72$

$-4v^2 - 2v + 72 = 0$

$a=-4$   $b=-2$   $c=72$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(-4)(72)}}{2(-4)}$$

$$x = \frac{2 \pm \sqrt{1156}}{-8}$$

$$x = \frac{2 \pm 34}{-8} \rightarrow \begin{cases} x = \frac{2 + 34}{-8} = \boxed{-\frac{9}{2}} \\ x = \frac{2 - 34}{-8} = \boxed{4} \end{cases}$$

Find the value of the discriminant of each quadratic equation.

$$b^2 - 4ac$$

25)  $7x^2 - x - 9 = 0$

$a=7$   $b=-1$   $c=-9$

$$(-1)^2 - 4(7)(-9)$$

$$= 1 + 252$$

$$= \boxed{253}$$

26)  $-8n^2 + 10n + 8 = 0$

$a=-8$   $b=10$   $c=8$

$$(10)^2 - 4(-8)(8)$$

$$= 100 + 256$$

$$= \boxed{356}$$

Use the discriminant to determine the number of real solutions to each equation.

27)  $-5x^2 + 10x - 4 = 5$

$-5x^2 + 10x - 9 = 0$

$a=-5$   $b=10$   $c=-9$

$$(10)^2 - 4(-5)(-9)$$

$$= 100 - 180$$

$$= -80$$

↑ no solutions since  $< 0$

28)  $7x^2 - 2 = 9x^2 - 4x$

$-7x^2 + 4x - 2 = 0$

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

$a=2$   $b=-4$   $c=2$

$$(-4)^2 - 4(2)(2)$$

$$= 16 - 16$$

$$= 0$$

↑ one solution since  $= 0$

### Answers to Solving Quadratic Equations (ID: 1)

1)  $\left\{-4, -\frac{3}{5}\right\}$

5)  $\{-8, 2\}$

9)  $\left\{-\frac{5}{2}, \frac{6}{5}\right\}$

13)  $\left\{\frac{1}{2}, -\frac{1}{2}\right\}$

16)  $\{11, 9\}$

20)  $\left\{\frac{9}{2}, -4\right\}$

24)  $\left\{-\frac{9}{2}, 4\right\}$

28) One

2)  $\{-4, 7\}$

6)  $\{5, 3\}$

10)  $\left\{\frac{4}{3}, -1\right\}$

14)  $\{2, -2\}$

17)  $\{3, -1\}$

21)  $\left\{-\frac{9}{2}, \frac{5}{2}\right\}$

25)  $253^2$

3)  $\{-3, -7\}$

7)  $\{5, 4\}$

11)  $\left\{-\frac{3}{2}, 2\right\}$

15)  $\{1 + \sqrt{17}, 1 - \sqrt{17}\}$

18)  $\{3, -1\}$

22)  $\{16, -4\}$

26) 356

4)  $\{-8\}$

8)  $\{-8, 3\}$

12)  $\left\{-\frac{5}{4}, -3\right\}$

19)  $\left\{\frac{14}{5}, -4\right\}$

23)  $\{-3, 3\}$

27) None