KIDSLEARN MATH · PRACTICE ASSIGNMENT

Quadratic Formula

Name: Date: Score: / 50

For $ax^2+bx+c=0$: $x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$ and $\Delta=b^2-4ac$. Give answers that are not whole numbers as fractions in lowest terms. Answers are at the end.

Part A — Warm-up

1. Rearrange $2x^2-x=-2$ into the form $ax^2+bx+c=0$ with $a=2$. What is c?

2. Compare $4x^2+1=0$ with $ax^2+bx+c=0$. What is b?

3. The equation $7+4x+4x^2=0$ is written as $ax^2+bx+c=0$. What is c?

4. Find the discriminant $\Delta=b^2-4ac$ of $-4x^2-3x-5=0$.

5. Find the discriminant $\Delta=b^2-4ac$ of $4x^2+10x+3=0$.

6. Find the discriminant $\Delta=b^2-4ac$ of $5x^2+x+2=0$.

7. Find the discriminant $\Delta=b^2-4ac$ of $3x^2-8x-10=0$.

8. Factor x^2+6x+9.

(A) $(x-3)^2$ (B) $(x+6)(x+1)$
(C) $(x+3)(x-3)$ (D) $(x+3)^2$

9. Factor $x^2+7x+12$.

(A) $(x+4)(x+3)$ (B) $(x-4)(x-3)$
(C) $(x-4)(x+3)$ (D) $(x+4)(x-3)$

10. Factor $x^2+12x+35$.

(A) $(x-5)(x+7)$ (B) $(x-5)(x-7)$
(C) $(x+5)(x+7)$ (D) $(x+5)(x-7)$

11. Factor $x^2 + 5x + 4$.

(A) $(x + 4)(x - 1)$ (B) $(x - 4)(x - 1)$

(C) $(x + 4)(x + 1)$ (D) $(x - 4)(x + 1)$

12. Solve $x^2 - 9x + 20 = 0$. Give the larger solution.

13. Solve $x^2 - x - 6 = 0$. Give the larger solution.

14. Solve $x^2 - 5x - 6 = 0$. Give the smaller solution.

15. Solve $x^2 - 4x - 12 = 0$. Give the larger solution.

Part B — Core practice

16. How many real solutions does $-2x^2 - 2x - 10 = 0$ have?

(A) Two different real solutions

(B) Exactly one (repeated) real solution

(C) No real solutions

17. How many real solutions does $-4x^2 + 24x - 36 = 0$ have?

(A) Two different real solutions

(B) Exactly one (repeated) real solution

(C) No real solutions

18. How many real solutions does $-3x^2 - 2x + 4 = 0$ have?

(A) Two different real solutions

(B) Exactly one (repeated) real solution

(C) No real solutions

19. How many real solutions does $4x^2 + 7x + 3 = 0$ have?

(A) Two different real solutions

(B) Exactly one (repeated) real solution

(C) No real solutions

20. Factor $x^2 - 10x + 21$.

(A) $(x - 3)(x + 7)$ (B) $(x + 3)(x + 7)$

(C) $(x - 3)(x - 7)$ (D) $(x + 3)(x - 7)$

21. Factor $x^2 - x - 30$.

(A) $(x + 5)(x - 6)$ (B) $(x + 5)(x + 6)$

(C) $(x - 5)(x + 6)$ (D) $(x - 5)(x - 6)$

22. Factor $x^2 + x - 56$.

(A) $(x + 7)(x + 8)$ (B) $(x - 7)(x - 8)$
(C) $(x + 7)(x - 8)$ (D) $(x - 7)(x + 8)$

23. Factor $x^2 + 2x - 63$.

(A) $(x + 9)(x + 7)$ (B) $(x + 9)(x - 7)$
(C) $(x - 9)(x + 7)$ (D) $(x - 9)(x - 7)$

24. Solve $3x^2 - 9x - 84 = 0$. What is the product of its two solutions?

25. Solve $4x^2 - 12x - 160 = 0$. What is the product of its two solutions?

26. Solve $4x^2 - 28x - 72 = 0$. What is the product of its two solutions?

27. Solve $4x^2 - 36x + 56 = 0$. Give the larger solution.

28. Solve $3x^2 - 14x - 49 = 0$. Give the smaller solution.

29. Solve $3x^2 + 26x + 48 = 0$. Give the larger solution.

30. Solve $3x^2 - 20x - 7 = 0$. Give the smaller solution.

31. Solve $4x^2 - 13x - 12 = 0$. Give the smaller solution.

32. Find the smallest value of $y = x^2 + 4x + 8$.

33. Find the smallest value of $y = 2x^2 - 16x - 5$.

34. Find the smallest value of $y = x^2 + 2x - 8$.

35. The parabola $y = -3x^2 - 2x + 2$ is symmetric about a vertical line $x = k$. Find k.

36. Solve $x^2 = 2x + 24$. Give the larger solution.

37. Solve $x^2 = -x + 20$. Give the larger solution.

38. Solve $x^2 = 7x + 18$. Give the larger solution.

Part C — Challenge

39. Solve $x^2 - 7x + 5 = 0$. Give the solutions in simplest radical form.

(A) $x = \dfrac{7 \pm \sqrt{29}}{2}$ (B) $x = 7 \pm \sqrt{29}$

(C) $x = \dfrac{7 \pm \sqrt{69}}{2}$ (D) $x = \dfrac{-7 \pm \sqrt{29}}{2}$

40. Solve $2x^2 - 8x + 4 = 0$. Give the solutions in simplest radical form.

(A) $x = 4 \pm 2\sqrt{2}$ (B) $x = 2 \pm \sqrt{2}$

(C) $x = 2 \pm \sqrt{6}$ (D) $x = -2 \pm \sqrt{2}$

41. Solve $3x^2 + 2x - 3 = 0$. Give the solutions in simplest radical form.

(A) $x = \dfrac{-1 \pm \sqrt{10}}{3}$

(B) $x = \dfrac{-1 \pm 2\sqrt{10}}{3}$

(C) $x = \dfrac{1 \pm \sqrt{10}}{3}$

(D) $x = \dfrac{-2 \pm 2\sqrt{10}}{3}$

42. Solve $x^2 - 6x - 4 = 0$. Give the solutions in simplest radical form.

(A) $x = 3 \pm \sqrt{5}$ (B) $x = -3 \pm \sqrt{13}$

(C) $x = 6 \pm 2\sqrt{13}$ (D) $x = 3 \pm \sqrt{13}$

43. The equation $x^2 + kx + 16 = 0$ has exactly one solution, and $k > 0$. Find k.

44. For what value of k does $x^2 + 4x + k = 0$ have exactly one solution?

45. For what value of k does $x^2 + 12x + k = 0$ have exactly one solution?

46. One solution of $x^2 + 14x + 48 = 0$ is $x = -8$. Find the other solution.

47. A ball is thrown upward from a cliff. Its height above the sea after t seconds is $h = -5t^2 + 10t + 15$ metres. After how many seconds does it hit the water?

48. A ball is thrown upward from a cliff. Its height above the sea after t seconds is $h = -5t^2 + 10t + 120$ metres. After how many seconds does it hit the water?

49. The product of two consecutive positive whole numbers is 132. What is the smaller number?

50. A ball is thrown upward from a cliff. Its height above the sea after t seconds is $h = -5t^2 + 15t + 50$ metres. After how many seconds does it hit the water?

Answer Key — Quadratic Formula

1. 2
   Add 2 on both sides: $2x^2 - x + 2 = 0$, so $c = 2$.

2. 0
   There is no x term, so $b = 0$.

3. 7
   Reorder it: $4x^2 + 4x + 7 = 0$. So $c = 7$.

4. -71
   $a = -4, b = -3, c = -5$: $\Delta = (-3)^2 - 4(-4)(-5) = 9 - 80 = -71$.

5. 52
   $a = 4, b = 10, c = 3$: $\Delta = 10^2 - 4(4)(3) = 100 - 48 = 52$.

6. -39
   $a = 5, b = 1, c = 2$: $\Delta = 1^2 - 4(5)(2) = 1 - 40 = -39$.

7. 184
   $a = 3, b = -8, c = -10$: $\Delta = (-8)^2 - 4(3)(-10) = 64 + 120 = 184$.

8. **(D)** $(x + 3)^2$
   Find two numbers that add to 6 and multiply to 9: 3 and 3. So $x^2 + 6x + 9 = (x + 3)^2$.

9. **(A)** $(x + 4)(x + 3)$
   Find two numbers that add to 7 and multiply to 12: 4 and 3. So $x^2 + 7x + 12 = (x + 4)(x + 3)$.

10. **(C)** $(x + 5)(x + 7)$
    Find two numbers that add to 12 and multiply to 35: 5 and 7. So $x^2 + 12x + 35 = (x + 5)(x + 7)$.

11. **(C)** $(x + 4)(x + 1)$
    Find two numbers that add to 5 and multiply to 4: 4 and 1. So $x^2 + 5x + 4 = (x + 4)(x + 1)$.

12. 5
    Factor: $(x - 5)(x - 4) = 0$, so $x = 5$ or $x = 4$. The larger is 5.

13. 3
    Factor: $(x - 3)(x + 2) = 0$, so $x = 3$ or $x = -2$. The larger is 3.

14. -1
    Factor: $(x + 1)(x - 6) = 0$, so $x = -1$ or $x = 6$. The smaller is -1.

15. 6
    Factor: $(x - 6)(x + 2) = 0$, so $x = 6$ or $x = -2$. The larger is 6.

16. **(C) No real solutions**
    $\Delta = (-2)^2 - 4(-2)(-10) = 4 - 80 = -76$, which is negative: no real solutions.

17. **(B) Exactly one (repeated) real solution**
    $\Delta = 24^2 - 4(-4)(-36) = 576 - 576 = 0$, which is zero: one repeated solution.

18. **(A) Two different real solutions**
    $\Delta = (-2)^2 - 4(-3)(4) = 4 + 48 = 52$, which is positive: two solutions.

19. **(A) Two different real solutions**
    $\Delta = 7^2 - 4(4)(3) = 49 - 48 = 1$, which is positive: two solutions.

20. **(C)** $(x - 3)(x - 7)$
    Find two numbers that add to -10 and multiply to 21: -3 and -7. So $(x - 3)(x - 7)$.

21. **(A)** $(x + 5)(x - 6)$
    Find two numbers that add to -1 and multiply to -30: 5 and -6. So $(x + 5)(x - 6)$.

22. **(D)** $(x - 7)(x + 8)$
    Find two numbers that add to 1 and multiply to -56: -7 and 8. So $(x - 7)(x + 8)$.

23. **(B)** $(x + 9)(x - 7)$
    Find two numbers that add to 2 and multiply to -63: 9 and -7. So $(x + 9)(x - 7)$.

24. -28
    $\Delta = (-9)^2 - 4(3)(-84) = 81 + 1008 = 1089$, $\sqrt{\Delta} = 33$. $x = \dfrac{9 \pm 33}{6}$, so $x = 7$ or $x = -4$. The product is -28.

25. -40
    $\Delta = (-12)^2 - 4(4)(-160) = 144 + 2560 = 2704$, $\sqrt{\Delta} = 52$.
    $x = \dfrac{12 \pm 52}{8}$, so $x = 8$ or $x = -5$. The product is -40.

26. -18

$\Delta = (-28)^2 - 4(4)(-72)$
$= 784 + 1152 = 1936$, $\sqrt{\Delta} = 44$.
$x = \dfrac{28 \pm 44}{8}$, so $x = 9$ or $x = -2$. The product is -18.

27. 7

$\Delta = (-36)^2 - 4(4)(56) = 1296 - 896 = 400$,
$\sqrt{\Delta} = 20$. $x = \dfrac{36 \pm 20}{8}$, so $x = 7$ or $x = 2$.

28. $-\frac{7}{3}$

$\Delta = (-14)^2 - 4(3)(-49) = 196 + 588 = 784$.
$x = \dfrac{14 \pm 28}{6}$, so $x = 7$ or $x = -\frac{7}{3}$.

29. $-\frac{8}{3}$

$\Delta = 26^2 - 4(3)(48) = 676 - 576 = 100$.
$x = \dfrac{-26 \pm 10}{6}$, so $x = -\frac{8}{3}$ or $x = -6$.

30. $-\frac{1}{3}$

$\Delta = (-20)^2 - 4(3)(-7) = 400 + 84 = 484$.
$x = \dfrac{20 \pm 22}{6}$, so $x = 7$ or $x = -\frac{1}{3}$.

31. $-\frac{3}{4}$

$\Delta = (-13)^2 - 4(4)(-12) = 169 + 192 = 361$.
$x = \dfrac{13 \pm 19}{8}$, so $x = 4$ or $x = -\frac{3}{4}$.

32. 4

The minimum is at the vertex, $x = \dfrac{-b}{2a} = -2$:
$y = 1(-2)^2 + 4(-2) + 8 = 4$.

33. -37

The minimum is at the vertex, $x = \dfrac{-b}{2a} = 4$:
$y = 2(4)^2 - 16(4) - 5 = -37$.

34. -9

The minimum is at the vertex, $x = \dfrac{-b}{2a} = -1$:
$y = 1(-1)^2 + 2(-1) - 8 = -9$.

35. $-\frac{1}{3}$

The axis of symmetry passes through the vertex:
$k = \dfrac{-b}{2a} = \dfrac{-(-2)}{2 \times (-3)} = -\frac{1}{3}$.

36. 6

Make one side zero: $x^2 - 2x - 24 = 0$, so $(x - 6)(x + 4) = 0$ and $x = 6$ or $x = -4$.

37. 4

Make one side zero: $x^2 + x - 20 = 0$, so $(x - 4)(x + 5) = 0$ and $x = 4$ or $x = -5$.

38. 9

Make one side zero: $x^2 - 7x - 18 = 0$, so $(x - 9)(x + 2) = 0$ and $x = 9$ or $x = -2$.

39. **(A)** $x = \dfrac{7 \pm \sqrt{29}}{2}$

$\Delta = (-7)^2 - 4(1)(5) = 49 - 20 = 29$ and $\sqrt{29} = \sqrt{29}$. So $x = \dfrac{7 \pm \sqrt{29}}{2} = \dfrac{7 \pm \sqrt{29}}{2}$.

40. **(B)** $x = 2 \pm \sqrt{2}$

$\Delta = (-8)^2 - 4(2)(4) = 64 - 32 = 32$ and $\sqrt{32} = 4\sqrt{2}$. So $x = \dfrac{8 \pm 4\sqrt{2}}{4} = 2 \pm \sqrt{2}$.

41. **(A)** $x = \dfrac{-1 \pm \sqrt{10}}{3}$

$\Delta = 2^2 - 4(3)(-3) = 4 + 36 = 40$ and $\sqrt{40} = 2\sqrt{10}$. So $x = \dfrac{-2 \pm 2\sqrt{10}}{6} = \dfrac{-1 \pm \sqrt{10}}{3}$.

42. **(D)** $x = 3 \pm \sqrt{13}$

$\Delta = (-6)^2 - 4(1)(-4) = 36 + 16 = 52$ and $\sqrt{52} = 2\sqrt{13}$. So $x = \dfrac{6 \pm 2\sqrt{13}}{2} = 3 \pm \sqrt{13}$.

43. 8

$\Delta = k^2 - 4(16) = 0$, so $k^2 = 64$ and $k = 8$ (taking the positive value).

44. 4

One solution means $\Delta = 0$: $4^2 - 4(1)k = 0$, so $4k = 16$ and $k = 4$.

45. 36

One solution means $\Delta = 0$: $12^2 - 4(1)k = 0$, so $4k = 144$ and $k = 36$.

46. -6

The equation factors with $(x + 8)$ as one bracket: $(x + 8)(x + 6) = 0$, so the other solution is $x = -6$. (Check: $-8 + (-6) = -14 = -b$.)

47. **3 s**

Set $h = 0$ and divide by -5: $t^2 - 2t - 3 = 0$, so $(t - 3)(t + 1) = 0$. Time is positive, so $t = 3$ s.

48. **6 s**

Set $h = 0$ and divide by -5: $t^2 - 2t - 24 = 0$, so $(t - 6)(t + 4) = 0$. Time is positive, so $t = 6$ s.

49. 11

$n(n + 1) = 132$ gives $n^2 + n - 132 = 0$, that is $(n - 11)(n + 12) = 0$. The positive solution is $n = 11$.

50. $5\ \mathbf{s}$

Set $h = 0$ and divide by -5: $t^2 - 3t - 10 = 0$, so $(t - 5)(t + 2) = 0$. Time is positive, so $t = 5$ s.