

Section 4.4 – Practice Problems

Find the Discriminant, use it to determine the number of real roots of each equation.

1. $x^2 - 8x + 16 = 0$ Discriminant:
 $b^2 - 4ac$

$$(-8)^2 - 4(1)(16)$$

$$64 - 64$$

$$0$$

1 solution rational

2. $2x^2 - x - 3 = 0$

$$(-1)^2 - 4(2)(-3)$$

$$1 + 24$$

$$25$$

2 solutions rational

3. $3x^2 - 4x + 5 = 0$

$$(-4)^2 - 4(3)(5)$$

$$16 - 60$$

$$-44$$

0 solutions

4. $3x^2 - 5x + 1 = 0$

$$(-5)^2 - 4(3)(1)$$

$$25 - 12$$

$$13$$

2 solutions irrational

5. $2x^2 - 6x = 0$

$$(-6)^2 - 4(2)(0)$$

$$36$$

2 solutions rational

6. $\frac{(2-x)3x-2}{2x-1} = \frac{1}{2x} \cdot (2x-1)$

$$(2-x)(3x-2) = 2x-1$$

$$6x - 4 - 3x^2 + 2x - 2x + 1 = 0$$

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

$$6^2 - 4(-3)(-3)$$

$$36 - 36$$

$$0$$

1 real solution

7. $(2x+3)(x-1) = x+5$

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

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

$$0 - 4(2)(-8)$$

$$64$$

2 solutions rational

8. $x^2 - 2\sqrt{2}x + 2 = 0$

$$(-2\sqrt{2})^2 - 4(1)(2)$$

$$8 - 8$$

$$0$$

1 real root irrational

Determine the value of k so that the equation had the indicated number of solutions

9. $kx^2 + x + k = 0$; two real solutions

$$b^2 - 4ac > 0$$

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

$$1 - 4k^2 > 0$$

$$1 > 4k^2$$

$$\frac{1}{4} > k^2$$

$$\frac{1}{2} > |k|$$

$$-\frac{1}{2} < k < \frac{1}{2}$$

10. $kx^2 + x + k = 0$; one real solution

$$b^2 - 4ac = 0$$

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

$$1 = 4k^2$$

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

$$k = \pm \frac{1}{2}$$

11. $x^2 - kx + 4 = 0$; two real solutions

$$b^2 - 4ac > 0$$

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

$$k^2 - 16 > 0$$

$$k^2 > 16$$

$$|k| > 4$$

$$k < -4$$

$$k > 4$$

12. $x^2 - kx + 4 = 0$; no real solutions

$$b^2 - 4ac < 0$$

$$k^2 - 16 < 0$$

$$k^2 < 16$$

$$k < |4|$$

$$-4 < k < 4$$

Solve the following questions using the Quadratic Equation. Leave answers in radical form.

13. $x^2 = -4x - 1$

$$x^2 + 4x + 1 = 0$$

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

$$\frac{-4 \pm \sqrt{12}}{2} \rightarrow \frac{-4 \pm 2\sqrt{3}}{2}$$

$$-2 \pm \sqrt{3}$$

14. $x^2 = 4 - 4x$

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

$$\frac{-4 \pm \sqrt{16 - 4(1)(-4)}}{2(1)}$$

$$\frac{-4 \pm \sqrt{32}}{2}$$

$$\frac{-4 \pm 4\sqrt{2}}{2}$$

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

15. $x^2 = -4x + 1$

$$x^2 + 4x - 1 = 0$$

$$\frac{-4 \pm \sqrt{16 - 4(1)(-1)}}{2(1)}$$

$$\frac{-4 \pm \sqrt{20}}{2} \rightarrow \frac{-4 \pm 2\sqrt{5}}{2}$$

$$-2 \pm \sqrt{5}$$

16. $2x^2 = 3x + 1$

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

$$\frac{3 \pm \sqrt{9 - 4(2)(-1)}}{2(2)}$$

$$\frac{3 \pm \sqrt{17}}{4}$$

$$\frac{3 \pm \sqrt{17}}{4}$$

$$17. \frac{8x^2}{4} + \frac{8 \cdot 1}{8} = \frac{x \cdot 8}{2} \quad \text{LCD: } 8$$

$$2x^2 + 1 = 4x \rightarrow 2x^2 - 4x + 1 = 0$$

$$\frac{4 \pm \sqrt{16 - 4(2)(1)}}{2(2)}$$

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

$$\frac{4 \pm 2\sqrt{2}}{4} \rightarrow \boxed{\frac{2 \pm \sqrt{2}}{2}}$$

$$19. \frac{x(2x+1)}{x-2} = \frac{10}{x-2}$$

COMMON
DENOMINATOR
(x-2)
so just
remove it

$$x(2x+1) = 10$$

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

$$\frac{-1 \pm \sqrt{1 - 4(2)(-10)}}{2(2)}$$

$$\frac{-1 \pm \sqrt{81}}{4}$$

$$\frac{-1 \pm 9}{4} = \frac{8}{4} \text{ and } \frac{-10}{4}$$

reject \rightarrow $\boxed{2 \text{ and } \frac{-5}{2}}$
because it
gives 0 denominator

$$18. 8x^2 - 20x - 3 = 0$$

$$\frac{+20 \pm \sqrt{400 - 4(8)(-3)}}{2(8)}$$

$$\frac{20 \pm \sqrt{496}}{16} \rightarrow \frac{20 \pm \sqrt{16 \cdot 31}}{16}$$

$$\frac{20 \pm 4\sqrt{31}}{16} = \boxed{\frac{5 \pm \sqrt{31}}{4}}$$

$$20. (x-2)(x+4) = 2x(x-3)$$

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

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

$$\frac{-8 \pm \sqrt{64 - 4(-1)(-8)}}{2(-1)}$$

$$\frac{-8 \pm \sqrt{32}}{-2}$$

$$\frac{-8 \pm 4\sqrt{2}}{-2}$$

$$\boxed{4 \pm 2\sqrt{2}}$$

$$21. \frac{x^2}{12} + \frac{x}{4} = -\frac{1}{3}$$

LCD: 12

$$x^2 + 3x = -4$$

$$x^2 + 3x + 4 = 0$$

$$\frac{-3 \pm \sqrt{9 - 4(1)(4)}}{2}$$

$$\frac{-3 \pm \sqrt{-7}}{2} \leftarrow \text{NOT ALLOWED}$$

NO SOLUTION
 \emptyset

Solve using any method.

$$23. \frac{3x \cdot x}{3} - \frac{3x}{2} = -\frac{3 \cdot 3x}{x} \quad \text{LCD: } 3x$$

$$x^2 - 6x = -9$$

$$x^2 - 6x + 9 = 0$$

$$(x-3)(x-3)$$

$x = 3$

$$22. (x+3)^2 = 6x(x+1)$$

$$x^2 + 6x + 9 = 6x^2 + 6x$$

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

$$\frac{0 \pm \sqrt{0 - 4(-5)(9)}}{2(-5)}$$

$$\frac{0 \pm \sqrt{180}}{-10}$$

$$\frac{\pm \sqrt{36 \cdot 5}}{-10}$$

$$\frac{\pm 6\sqrt{5}}{-10}$$

$\frac{\pm 3\sqrt{5}}{5}$

$$24. \frac{2x}{3x-1} = \frac{2x-3}{x+1} \quad \text{LCD: } (3x-1)(x+1)$$

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

$$2x^2 + 2x = 6x^2 - 2x - 9x + 3$$

$$2x^2 + 2x = 6x^2 - 11x + 3$$

$$-4x^2 + 13x - 3 = 0$$

$$4x^2 - 13x + 3 = 0$$

$$\text{AC: } x^2 - 13x + 12$$

$$\left(\frac{x-12}{4}\right)\left(\frac{x-1}{4}\right)$$

$x = 3$
 $x = \frac{1}{4}$

$$25. \frac{x+2}{x} + \frac{x}{x-2} = 5$$

$$\text{LCD: } x(x-2)$$

$$(x+2)(x-2) + x(x) = 5(x)(x-2)$$

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

$$-3x^2 + 10x - 4 = 0$$

$$3x^2 - 10x + 4 = 0$$

$$\frac{10 \pm \sqrt{100 - 4(3)(4)}}{2(3)} \rightarrow \frac{10 \pm \sqrt{52}}{6}$$

$$\frac{10 \pm 2\sqrt{13}}{6} \rightarrow \boxed{\frac{5 \pm \sqrt{13}}{3}}$$

$$27. \sqrt{2x-1} = x-2$$

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

$$2x-1 = x^2 - 4x + 4$$

$$x^2 - 6x + 5 = 0$$

$$(x-5)(x-1) = 0$$

$$\boxed{x=5} \text{ and } x=1 \leftarrow \text{reject}$$

check:

$$\sqrt{10-1} = 5-2 \quad \sqrt{2-1} = 1-2$$

$$\sqrt{9} = 3$$

$$3 = 3$$

$$1 = -1$$

NO

$$26. \frac{2}{x+4} - \frac{3}{x+1} = 4$$

$$\text{LCD: } (x+4)(x+1)$$

$$2(x+1) - 3(x+4) = 4(x+4)(x+1)$$

$$2x+2 - 3x-12 = 4(x^2+5x+4)$$

$$-x-10 = 4x^2+20x+16$$

$$4x^2+21x+26$$

$$\frac{-21 \pm \sqrt{21^2 - 4(4)(26)}}{8} \rightarrow \frac{-21 \pm \sqrt{441 - 416}}{8}$$

$$\frac{-21 \pm \sqrt{25}}{8} \rightarrow \frac{-21 \pm 5}{8}; \boxed{\begin{matrix} -2 \text{ and} \\ -\frac{13}{4} \end{matrix}}$$

$$28. \sqrt{x^2+1} = \sqrt{3x+2}$$

square both sides

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

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

$$\frac{3 \pm \sqrt{9-4(1)(-1)}}{2} \rightarrow \boxed{\frac{3 \pm \sqrt{13}}{2}}$$

should check both too

both work!

$$29. \left(\frac{x^2+2}{x}\right)^2 - 6\left(\frac{x^2+2}{x}\right) + 5 = 0$$

$$\text{Let } \left(\frac{x^2+2}{x}\right) = z$$

$$z^2 - 6z + 5 = 0$$

$$(z-5)(z-1) = 0$$

$$z-5 = 0$$

$$\frac{x^2+2}{x} - 5 = 0$$

$$\frac{x^2+2-5x}{x} = 0$$

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

$$\frac{5 \pm \sqrt{25 - 4(1)(2)}}{2}$$

$$\boxed{\frac{5 \pm \sqrt{17}}{2}}$$

$$z-1 = 0$$

$$\frac{x^2+2}{x} - 1 = 0$$

$$\frac{x^2+2-x}{x} = 0$$

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

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

$$\frac{1 \pm \sqrt{-7}}{2}$$

no solution

$$30. \left(\frac{x^2+1}{x}\right)^2 + 4\left(\frac{x^2+1}{x}\right) - 12 = 0$$

$$\text{Let } \left(\frac{x^2+1}{x}\right) = z$$

$$z^2 + 4z - 12 = 0$$

$$(z+6)(z-2) = 0$$

$$z = -6$$

$$\frac{x^2+1}{x} = -6$$

$$x^2+1 = -6x$$

$$x^2+6x+1 = 0$$

$$\frac{-6 \pm \sqrt{36 - 4(1)(1)}}{2}$$

$$\frac{-6 \pm \sqrt{32}}{2}$$

$$\frac{-6 \pm 4\sqrt{2}}{2}$$

$$\boxed{-3 \pm 2\sqrt{2}}$$

$$z = 2$$

$$\frac{x^2+1}{x} = 2$$

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

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

$$(x-1)^2 = 0$$

$$\boxed{x = 1}$$