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A. **Solving Linear Equations** (1<sup>st</sup> degree)

Use inverse operations to isolate the variable.

1.  $-3 - y = -8$

$$-y = -5$$

$$\boxed{y = 5} \checkmark$$

2.  $d + 4 - 8d - 11 = -5d - 4 - 21$

$$-7d - 7 = -5d - 25$$

$$-2d = -18$$

$$\boxed{d = 9} \checkmark$$

3.  $\frac{1}{3}a = 27$

$$\boxed{a = 81} \checkmark$$

4.  $3(2x + 4) - (x + 15) = 4x - 3$

$$6x + 12 - x - 15 = 4x - 3$$

$$5x - 3 = 4x - 3$$

$$\boxed{x = 0} \checkmark$$

5.  $14y - 1 = 6$

$$14y = 7$$

$$\boxed{y = \frac{1}{2}} \checkmark$$

B. Solving Systems of Linear Equations  
Use substitution or linear combination.

6. 
$$\begin{cases} \textcircled{1} 2x + y = 3 \\ \textcircled{2} x + y = -2 \end{cases} \xrightarrow{x-1} \begin{array}{r} 2x + y = 3 \\ -x - y = 2 \\ \hline x = 5 \end{array} \rightarrow \begin{cases} \textcircled{2} 5 + y = -2 \\ y = -7 \end{cases}$$
  
$$\boxed{(5, -7)} \checkmark$$

7. 
$$\begin{cases} \textcircled{1} a + b = 7 \\ \textcircled{2} a - b = -1 \end{cases} \xrightarrow{\text{add}} \begin{array}{r} a + b = 7 \\ a - b = -1 \\ \hline 2a = 6 \\ a = 3 \end{array} \rightarrow \begin{cases} \textcircled{1} 3 + b = 7 \\ b = 4 \end{cases}$$
  
$$\boxed{(3, 4)} \checkmark$$

8. 
$$\begin{cases} \textcircled{1} 3x + y = -10 \\ \textcircled{2} y = 2x \end{cases} \rightarrow \begin{cases} \textcircled{1} 3x + 2x = -10 \\ 5x = -10 \\ x = -2 \end{cases} \rightarrow \begin{cases} \textcircled{1} y = -4 \end{cases}$$
  
$$\boxed{(-2, -4)} \checkmark$$

9. 
$$\begin{cases} \textcircled{1} 5c - 2d = 8 \\ \textcircled{2} 2c + 7d = 11 \end{cases} \xrightarrow{\begin{matrix} \times 7 \\ \times 2 \end{matrix}} \begin{array}{r} 35c - 14d = 56 \\ 4c + 14d = 22 \\ \hline 39c = 78 \\ c = 2 \end{array} \rightarrow \begin{cases} \textcircled{2} 4 + 7d = 11 \\ 7d = 7 \\ d = 1 \end{cases}$$
  
$$\boxed{(2, 1)} \checkmark$$

C. **Factoring Polynomials**

Factor by using (1) GCF, (2) Grouping, or (3) the Trinomial method.

10.  $20x^5 - 8x^4 + 4x^3$

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

11.  $(x^2 + xz) + (2xy + 2yz)$

$$x(x+z) + 2y(x+z)$$

$$(x+2y)(x+z)$$

12.  $x^2 + 6x + 5$

$$(x+1)(x+5)$$

13.  $x^2 - x - 12$

$$(x-4)(x+3)$$

14.  $3x^2 - 8x - 3$

$$(3x^2 - 9x) + (x - 3)$$

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

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

15.  $6x^2 + 8x + 2$

$$2(3x^2 + 4x + 1)$$

$$2[(3x^2 + 3x) + (x + 1)]$$

$$2[3x(x+1) + 1(x+1)]$$

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

16.  $x^2 - 1$

$$(x-1)(x+1)$$

17.  $x^2 - 25$

$$(x-5)(x+5)$$

18.  $4x^2 - 9$

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

19.  $3(x-3)^2 - 12$

$$3[(x-3)^2 - 4]$$

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

$$3(x-5)(x-1)$$

D. **Simplifying Radicals**

Radicals are simplified (in simplest radical form/SRF) if

- (1) no perfect square factors are under the radical symbol.
- (2) no fractions are inside the radical symbol.
- (3) no radical expressions are in the denominator.

$$20. \quad \frac{\sqrt{24}}{\sqrt{4}\sqrt{6}}$$

$$\boxed{2\sqrt{6}}$$

$$21. \quad \frac{\sqrt{80}}{\sqrt{16}\sqrt{5}}$$

$$\boxed{4\sqrt{5}}$$

$$22. \quad \frac{\sqrt{27}}{\sqrt{9}\sqrt{3}}$$

$$\boxed{3\sqrt{3}}$$

$$23. \quad \frac{\sqrt{150}}{\sqrt{25}\sqrt{6}}$$

$$\boxed{5\sqrt{6}}$$

$$24. \quad \frac{\sqrt{\frac{20}{12}}}{\sqrt{\frac{5}{3}}}$$

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

$$\boxed{\frac{\sqrt{15}}{3}}$$

$$25. \quad \frac{\sqrt{\frac{1}{18}}}{\sqrt{\frac{1}{9}}\sqrt{2}}$$

$$\frac{\frac{1}{3\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}}{\frac{\sqrt{2}}{\sqrt{2}}}$$

$$\boxed{\frac{\sqrt{2}}{6}}$$

$$26. \quad \frac{\sqrt{5} \cdot \sqrt{15}}{\sqrt{75}}$$

$$\frac{\sqrt{25}\sqrt{3}}{\sqrt{25}\sqrt{3}}$$

$$\boxed{5\sqrt{3}}$$

$$27. \quad \frac{\sqrt{2} \cdot \sqrt{6} \cdot \sqrt{3}}{\sqrt{36}}$$

$$\boxed{6}$$

$$28. \quad \frac{-6 \pm \sqrt{20}}{2}$$

$$\frac{-6 \pm \sqrt{4}\sqrt{5}}{2}$$

$$\frac{-6 \pm 2\sqrt{5}}{2}$$

$$\boxed{-3 \pm \sqrt{5}}$$

$$29. \quad \frac{3 \pm \sqrt{45}}{6}$$

$$\frac{3 \pm \sqrt{9}\sqrt{5}}{6}$$

$$\frac{3 \pm 3\sqrt{5}}{6}$$

$$\boxed{\frac{1 \pm \sqrt{5}}{2}}$$

E. Solving Quadratic Equations (2<sup>nd</sup> degree)

Solve by finding square roots, factoring, or the quadratic formula.

30.  $x^2 - 11x + 10 = 0$

$$(x-10)(x-1) = 0$$

$$x = 1, 10$$

31.  $49x^2 = 64$

$$x^2 = \frac{64}{49}$$

$$x = \pm \sqrt{\frac{64}{49}}$$

$$x = \pm \frac{8}{7}$$

32.  $2y^2 - 1 = 0$

$$2y^2 = 1$$

$$y^2 = \frac{1}{2}$$

$$y = \pm \sqrt{\frac{1}{2}}$$

$$y = \pm \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$$

$$y = \pm \frac{\sqrt{2}}{2}$$

33.  $d^2 + 3d = 0$

$$d(d+3) = 0$$

$$d = -3, 0$$

34.  $3x^2 + x = 10$

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

$$(3x^2 - 5x) + (6x - 10) = 0$$

$$x(3x-5) + 2(3x-5) = 0$$

$$(3x-5)(x+2) = 0$$

$$x = -2, \frac{5}{3}$$

35.  $x^2 = 6 - 4x$

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

$$x = \frac{-4 \pm \sqrt{16 + 24}}{2}$$

$$x = \frac{-4 \pm \sqrt{40}}{2}$$

$$x = \frac{-4 \pm 2\sqrt{10}}{2}$$

$$x = -2 \pm \sqrt{10}$$

36.  $5(x-3)^2 = x-3$

$$5[x^2 - 6x + 9] = x - 3$$

$$5x^2 - 30x + 45 = x - 3$$

$$5x^2 - 31x + 48 = 0$$

$$(5x^2 - 15x) + (-16x + 48) = 0$$

$$5x(x-3) + (-16)(x-3) = 0$$

$$(x-3)(5x-16) = 0$$

$$x = 3, \frac{16}{5}$$

F. Solving Nth Degree Equations

Set the equation equal to zero and factor the resulting polynomial.

37.  $x^3 - 25x = 0$

$$x(x^2 - 25) = 0$$

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

$$x = 0, \pm 5$$

38.  $x^3 + 3x^2 - 4x - 12 = 0$

$$(x^3 + 3x^2) + (-4x - 12) = 0$$

$$x^2(x+3) - 4(x+3) = 0$$

$$(x+3)(x^2 - 4) = 0$$

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

$$x = -3, \pm 2$$

39.  $y^4 = 13y^2 - 36$

$$y^4 - 13y^2 + 36 = 0$$

$$(y^2 - 9)(y^2 - 4) = 0$$

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

$$y = \pm 2, \pm 3$$

40.  $b^5 - 29b^3 + 100b = 0$

$$b(b^4 - 29b^2 + 100) = 0$$

$$b(b^2 - 25)(b^2 - 4) = 0$$

$$b(b-5)(b+5)(b-2)(b+2) = 0$$

$$b = 0, \pm 2, \pm 5$$