

Solve each of the following equations.

a)  $3x^2 + 9x = 0$

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

$$3x = 0 \quad x+3 = 0$$

$$\boxed{x=0} \quad \boxed{x=-3}$$

c)  $x^2 - 21x + 20 = 0$   $\begin{array}{l} P \ 20 \\ S \ -21 \\ -20, -1 \end{array}$

$$(x-20)(x-1) = 0$$

$$x-20 = 0 \quad x-1 = 0$$

$$\boxed{x=20} \quad \boxed{x=1}$$

e)  $x^2 - 7x - 30 = 0$   $\begin{array}{l} P \ -30 \\ S \ -7 \\ -10, 3 \end{array}$

$$(x-10)(x+3) = 0$$

$$x-10 = 0 \quad x+3 = 0$$

$$\boxed{x=10} \quad \boxed{x=-3}$$

g)  $100x^2 - 4 = 0$

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

$$25x-2 = 0 \quad 25x+2 = 0$$

$$\boxed{x = \frac{2}{25}} \quad \boxed{x = -\frac{2}{25}}$$

i)  $9x^2 - 6x + 1 = 0$

$$9x^2 - 3x - 3x + 1 = 0$$

$$3x(3x-1) - 1(3x-1) = 0$$

$$(3x-1)(3x-1) = 0$$

$$3x-1 = 0 \quad 3x-1 = 0$$

$$\boxed{x = \frac{1}{3}} \quad \boxed{x = \frac{1}{3}}$$

k)  $2x^2 - 5x - 3 = 0$

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

$$2x(x-3) + 1(x-3) = 0$$

$$(2x+1)(x-3) = 0$$

$$2x+1 = 0 \quad x-3 = 0$$

$$\boxed{x = -\frac{1}{2}} \quad \boxed{x=3}$$

m)  $6x^2 + 13x + 5 = 0$

$$6x^2 + 10x + 3x + 5 = 0$$

$$2x(3x+5) + 1(3x+5) = 0$$

$$(2x+1)(3x+5) = 0$$

$$2x+1 = 0 \quad 3x+5 = 0$$

$$\boxed{x = -\frac{1}{2}} \quad \boxed{x = -\frac{5}{3}}$$

b)  $x^2 + 26x + 88 = 0$   $\begin{array}{l} P \ 88 \\ S \ 26 \\ 22, 4 \end{array}$

$$(x+22)(x+4) = 0$$

$$x+22 = 0 \quad x+4 = 0$$

$$\boxed{x=-22} \quad \boxed{x=-4}$$

d)  $4x^2 - 9 = 0$

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

$$2x+3 = 0 \quad 2x-3 = 0$$

$$\boxed{x = -\frac{3}{2}} \quad \boxed{x = \frac{3}{2}}$$

f)  $x^2 + 6x + 9 = 0$   $\begin{array}{l} P \ 9 \\ S \ 6 \\ 3, 3 \end{array}$

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

$$x+3 = 0 \quad x+3 = 0$$

$$\boxed{x=-3} \quad \boxed{x=-3}$$

h)  $x^2 + 2x + 1 = 0$   $\begin{array}{l} P \ 1 \\ S \ 2 \\ 1, 1 \end{array}$

$$(x+1)(x+1) = 0$$

$$x+1 = 0 \quad x+1 = 0$$

$$\boxed{x=-1} \quad \boxed{x=-1}$$

j)  $2x^2 - 3x - 20 = 0$   $\begin{array}{l} P \ -40 \\ S \ -3 \\ -8, 5 \end{array}$

$$2x^2 - 8x + 5x - 20 = 0$$

$$2x(x-4) + 5(x-4) = 0$$

$$(2x+5)(x-4) = 0$$

$$2x+5 = 0 \quad x-4 = 0$$

$$\boxed{x = -\frac{5}{2}} \quad \boxed{x=4}$$

l)  $3 - 4x + x^2 = 0$   $\begin{array}{l} P \ 3 \\ S \ -4 \\ -3, -1 \end{array}$

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

$$(x-3)(x-1) = 0$$

$$x-3 = 0 \quad x-1 = 0$$

$$\boxed{x=3} \quad \boxed{x=1}$$

n)  $5x^2 + 6x + 1 = 0$

$$5x^2 + 5x + x + 1 = 0$$

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

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

$$x+1 = 0 \quad 5x+1 = 0$$

$$\boxed{x=-1} \quad \boxed{x = -\frac{1}{5}}$$

$$\begin{aligned} \text{o) } 3x^2 + 6x + 3 &= 0 & P \ 1 \\ 3(x^2 + 2x + 1) &= 0 & S \ 2 \\ 3(x+1)(x+1) &= 0 & 1, 1 \\ x+1 &= 0 & x+1 = 0 \\ \boxed{x = -1} & \quad \boxed{x = -1} \end{aligned}$$

$$\begin{aligned} \text{q) } 11x^2 - 12x + 1 &= 0 & P \ 11 \\ 11x^2 - 11x - x + 1 &= 0 & S \ -12 \\ 11x(x-1) - 1(x-1) &= 0 & -11, -1 \\ (11x-1)(x-1) &= 0 \\ 11x-1 &= 0 & x-1 = 0 \\ \boxed{x = \frac{1}{11}} & \quad \boxed{x = 1} \end{aligned}$$

$$\begin{aligned} \text{s) } 4x^2 - 36 &= 0 \\ 4(x^2 - 9) &= 0 \\ 4(x+3)(x-3) &= 0 \\ x+3 &= 0 & x-3 = 0 \\ \boxed{x = -3} & \quad \boxed{x = 3} \end{aligned}$$

$$\begin{aligned} \text{u) } 121 - x^2 &= 0 \\ (11-x)(11+x) &= 0 \\ 11-x &= 0 & 11+x = 0 \\ \boxed{x = 11} & \quad \boxed{x = -11} \end{aligned}$$

$$\begin{aligned} \text{w) } 25x^2 - 16 &= 0 \\ (5x+4)(5x-4) &= 0 \\ 5x+4 &= 0 & 5x-4 = 0 \\ \boxed{x = -\frac{4}{5}} & \quad \boxed{x = \frac{4}{5}} \end{aligned}$$

$$\begin{aligned} \text{p) } 16x^2 - 20x - 6 &= 0 & P \ -24 \\ 2(8x^2 - 10x - 3) &= 0 & S \ -10 \\ 2(8x^2 - 12x + 2x - 3) &= 0 & -12, 2 \\ 2(4x(2x-3) + 1(2x-3)) &= 0 \\ 2(2x-3)(4x+1) &= 0 \\ 2x-3 &= 0 & 4x+1 = 0 \\ \boxed{x = \frac{3}{2}} & \quad \boxed{x = -\frac{1}{4}} \end{aligned}$$

$$\begin{aligned} \text{r) } 4x^2 - 4x - 3 &= 0 & P \ -12 \\ 4x^2 - 6x + 2x - 3 &= 0 & S \ -4 \\ 2x(2x-3) + 1(2x-3) &= 0 & -6, 2 \\ (2x+1)(2x-3) &= 0 \\ 2x+1 &= 0 & 2x-3 = 0 \\ \boxed{x = -\frac{1}{2}} & \quad \boxed{x = \frac{3}{2}} \end{aligned}$$

$$\begin{aligned} \text{t) } 2x + x^2 - 15 &= 0 & P \ -15 \\ x^2 + 2x - 15 &= 0 & S \ 2 \\ (x+5)(x-3) &= 0 & S_1 \ -3 \\ x+5 &= 0 & x-3 = 0 \\ \boxed{x = -5} & \quad \boxed{x = 3} \end{aligned}$$

$$\begin{aligned} \text{v) } 6x^2 - 30x + 24 &= 0 & P \ 4 \\ 6(x^2 - 5x + 4) &= 0 & S \ -5 \\ 6(x-4)(x-1) &= 0 & -4, -1 \\ x-4 &= 0 & x-1 = 0 \\ \boxed{x = 4} & \quad \boxed{x = 1} \end{aligned}$$

$$\begin{aligned} \text{x) } 4x^2 - 20x + 25 &= 0 & P \ 100 \\ 4x^2 - 10x - 10x + 25 &= 0 & S \ -20 \\ 2x(2x-5) - 5(2x-5) &= 0 & -10, -10 \\ (2x-5)(2x-5) &= 0 \\ 2x-5 &= 0 & 2x-5 = 0 \\ \boxed{x = \frac{5}{2}} & \quad \boxed{x = \frac{5}{2}} \end{aligned}$$