

Solutions \Rightarrow Solving Quadratic Equations
EXTRA PRACTICE

1a) $x^2 + 6x + 5 = 0$
 $(x+1)(x+5) = 0$
 $x+1=0$ or $x+5=0$
 $x=-1$ $x=-5$

b) $3x^2 + 7x + 2 = 0$ Multiply Add $\frac{1}{1} \times \frac{6}{6} = 6$
 $(3x^2 + 1x) + (6x + 2) = 0$ 6 7 $\frac{1}{1} + \frac{6}{6} = 7$
 $x(3x+1) + 2(3x+1) = 0$
 $(3x+1)(x+2) = 0$
 $3x+1=0$ or $x+2=0$
 $\frac{3x}{3} = \frac{-1}{3}$ $x = -2$
 $x = \frac{-1}{3}$

$$\begin{aligned}
 \text{c) } & 3p^2 - 11p - 20 = 0 && \text{Multiply} && \text{Add} && \underline{-15} \times \underline{4} = -60 \\
 & (3p^2 - 15p) + (4p - 20) = 0 && -60 && -11 && \underline{-15} + \underline{4} = -11 \\
 & 3p(p-5) + 4(p-5) = 0 \\
 & (p-5)(3p+4) = 0 \\
 & p-5=0 \text{ or } 3p+4=0 \\
 & p=5 && \frac{3p}{3} = \frac{-4}{3} \\
 & && p = \frac{-4}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{d) } & (x+3)^2 - 25 = 0 && * \text{ Special Case} \\
 & [(x+3)-5][(x+3)+5] && \hookrightarrow \text{Difference of Squares} \\
 & (x-2)(x+8) = 0 \\
 & x-2=0 \text{ or } x+8=0 \\
 & x=2 && x=-8
 \end{aligned}$$

OR Put in General Form & Factor!

$$\begin{array}{l}
 \text{e) } 6x^2 + x - 1 = 0 \quad \text{Multiply} \quad \text{Add} \quad \underline{-2} \times \underline{3} = -6 \\
 (6x^2 - 2x) + (3x - 1) = 0 \quad \quad \quad -6 \quad \quad 1 \quad \underline{-2} + \underline{3} = 1 \\
 2x(3x - 1) + 1(3x - 1) = 0 \\
 (3x - 1)(2x + 1) = 0 \\
 3x - 1 = 0 \quad \text{or} \quad 2x + 1 = 0 \\
 \frac{3x}{3} = \frac{1}{3} \quad \quad \quad \frac{2x}{2} = \frac{-1}{2} \\
 x = \frac{1}{3} \quad \quad \quad x = -\frac{1}{2}
 \end{array}$$

$$\begin{array}{l}
 \text{f) } 3m^2 - 10m + 3 = 0 \quad \text{Multiply} \quad \text{Add} \quad \underline{-1} \times \underline{-9} = 9 \\
 (3m^2 - 1m) - (9m + 3) = 0 \quad \quad \quad 9 \quad \quad -10 \quad \underline{-1} + \underline{-9} = -10 \\
 m(3m - 1) - 3(3m - 1) = 0 \\
 (3m - 1)(m - 3) = 0 \\
 3m - 1 = 0 \quad \text{or} \quad m - 3 = 0 \\
 \frac{3m}{3} = \frac{1}{3} \quad \quad \quad m = 3 \\
 m = \frac{1}{3}
 \end{array}$$

$$g) 16 + m^2 + 17m = 0$$

$$m^2 + 17m + 16 = 0$$

$$(m+16)(m+1) = 0$$

$$m+16=0 \text{ or } m+1=0$$

$$m = -16 \qquad m = -1$$

$$h) -37a + 4a^2 + 9 = 0$$

$$4a^2 - 37a + 9 = 0$$

$$(4a^2 - 1a)(-36a + 9) = 0$$

$$a(4a-1) - 9(4a-1) = 0$$

$$(4a-1)(a-9) = 0$$

$$4a-1=0 \text{ or } a-9=0$$

$$\frac{4a}{4} = \frac{1}{4} \qquad a = 9$$

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

$$\begin{array}{r} \text{Multiply} \\ 36 \end{array} \quad \begin{array}{r} \text{Add } -1 \times 36 = 36 \\ -37 \quad -1 + 36 = -37 \end{array}$$

Algebra

$$2a) \quad x^2 + 8x - 9 = 0$$

$$x^2 + 8x = 9$$

$$(x^2 + 8x + 16) = 9 + 16$$

$$(x + 4)^2 = 25$$

$$x + 4 = \pm \sqrt{25}$$

$$x + 4 = \pm 5$$

$$x = -4 \pm 5$$

$$x = -4 + 5 \quad \& \quad x = -4 - 5$$

$$x = 1 \quad \quad \quad x = -9$$

$$b) \quad 4x^2 - 8x - 5 = 0$$

$$4x^2 - 8x = 5$$

$$x^2 - 2x = \frac{5}{4}$$

$$(x^2 - 2x + 1) = \frac{5}{4} + 1$$

$$(x - 1)^2 = \frac{5}{4} + \frac{4}{4}$$

$$(x - 1)^2 = \frac{9}{4}$$

$$x - 1 = \pm \sqrt{\frac{9}{4}}$$

$$x - 1 = \pm \frac{3}{2}$$

$$x = 1 \pm \frac{3}{2}$$

$$x = \frac{2}{2} \pm \frac{3}{2}$$

$$x = \frac{2}{2} + \frac{3}{2} \quad \& \quad x = \frac{2}{2} - \frac{3}{2}$$

$$x = \frac{5}{2}$$

$$x = -\frac{1}{2}$$

$$c) \quad x^2 - 6x - 2 = 0$$

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

$$(x^2 - 6x + 9) = 2 + 9$$

$$(x - 3)^2 = 11$$

$$x - 3 = \pm \sqrt{11}$$

$$x = 3 \pm \sqrt{11}$$

$$x = 3 + \sqrt{11} \quad \& \quad x = 3 - \sqrt{11}$$

$$d) 9x^2 - 12x - 32 = 0$$

$$9x^2 - 12x = 32$$

$$x^2 - \frac{12}{9}x = \frac{32}{9}$$

$$x^2 - \frac{4}{3}x = \frac{32}{9} \text{ (lowest terms)}$$

$$\left(x^2 - \frac{4}{3}x + \frac{16}{36}\right) = \frac{32}{9} + \frac{16}{36}$$

$$\left(x - \frac{2}{3}\right)^2 = \frac{128}{36} + \frac{16}{36}$$

$$\left(x - \frac{2}{3}\right)^2 = \frac{144}{36}$$

$$\left(x - \frac{2}{3}\right)^2 = 4$$

$$x - \frac{2}{3} = \pm\sqrt{4}$$

$$x - \frac{2}{3} = \pm 2$$

$$x = \frac{2}{3} \pm 2$$

$$x = \frac{2}{3} + 2 \quad \& \quad x = \frac{2}{3} - 2$$

$$x = \frac{2}{3} + \frac{6}{3} \quad x = \frac{2}{3} - \frac{6}{3}$$

$$x = \frac{8}{3} \quad x = -\frac{4}{3}$$

$$e) \quad 4x^2 + 20x - 5 = 0$$

$$4x^2 + 20x = 5$$

$$x^2 + 5x = \frac{5}{4}$$

$$\left(x^2 + 5x + \frac{25}{4}\right) = \frac{5}{4} + \frac{25}{4}$$

$$\left(x + \frac{5}{2}\right)^2 = \frac{30}{4}$$

$$\left(x + \frac{5}{2}\right) = \pm \sqrt{\frac{30}{4}}$$

$$x = -\frac{5}{2} \pm \frac{\sqrt{30}}{2}$$

$$x = \frac{-5 + \sqrt{30}}{2} \quad \& \quad x = \frac{-5 - \sqrt{30}}{2}$$

$$f) \quad x^2 - 9 = 0$$

$$x^2 = 9$$

$$x = \pm \sqrt{9}$$

$$x = \pm 3$$

$$\begin{aligned}
 \text{g) } 5 &= x^2 + 4x \\
 x^2 + 4x - 5 &= 0 \text{ (GF)} \\
 x^2 + 4x &= 5 \\
 (x^2 + 4x + 4) &= 5 + 4 \\
 (x+2)^2 &= 9 \\
 x+2 &= \pm\sqrt{9} \\
 x+2 &= \pm 3 \\
 x &= -2 \pm 3 \\
 x &= -2+3 \quad \& \quad x = -2-3 \\
 x &= 1 \quad \quad \quad x = -5
 \end{aligned}$$

$$\begin{aligned}
 \text{h) } -9 &= -4x^2 - 2x \\
 4x^2 + 2x - 9 &= 0 \\
 4x^2 + 2x &= 9 \\
 x^2 + \frac{2}{4}x &= \frac{9}{4} \\
 x^2 + \frac{1}{2}x &= \frac{9}{4} \\
 x^2 + \frac{1}{2}x + \frac{1}{16} &= \frac{9}{4} + \frac{1}{16} \\
 \left(x + \frac{1}{4}\right)^2 &= \frac{36}{16} + \frac{1}{16} \\
 \left(x + \frac{1}{4}\right)^2 &= \frac{37}{16} \\
 x + \frac{1}{4} &= \pm \sqrt{\frac{37}{16}} \\
 x &= -\frac{1}{4} \pm \frac{\sqrt{37}}{4} \\
 x &= \frac{-1 + \sqrt{37}}{4} \quad \& \quad x = \frac{-1 - \sqrt{37}}{4}
 \end{aligned}$$

$$3. a) 0 = 2x^2 + 8x - 24$$

$$a=2; b=8; c=-24$$

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

$$x = \frac{-8 \pm \sqrt{(8)^2 - 4(2)(-24)}}{2(2)}$$

$$x = \frac{-8 \pm \sqrt{64 + 192}}{4}$$

$$x = \frac{-8 \pm \sqrt{256}}{4}$$

$$x = \frac{-8 \pm 16}{4}$$

$$x = \frac{-8 + 16}{4} \quad \& \quad x = \frac{-8 - 16}{4}$$

$$x = \frac{8}{4}$$

$$x = \frac{-24}{4}$$

$$x = 2$$

$$x = -6$$

$$b) \quad 0 = 6x^2 + x - 1$$

$$a = 6; \quad b = 1; \quad c = -1$$

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

$$x = \frac{-1 \pm \sqrt{(1)^2 - 4(6)(-1)}}{2(6)}$$

$$x = \frac{-1 \pm \sqrt{1 + 24}}{12}$$

$$x = \frac{-1 \pm \sqrt{25}}{12}$$

$$x = \frac{-1 \pm 5}{12}$$

$$x = \frac{-1+5}{12} \quad \& \quad x = \frac{-1-5}{12}$$

$$x = \frac{4}{12} \text{ or } \frac{1}{3} \quad x = \frac{-6}{12} \text{ or } -\frac{1}{2}$$

$$\begin{aligned} \text{c) } -5 &= x^2 - 6x \\ 0 &= x^2 - 6x + 5 \\ a &= 1; b = -6; c = 5. \end{aligned}$$

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

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(5)}}{2(1)}$$

$$x = \frac{6 \pm \sqrt{36 - 20}}{2}$$

$$x = \frac{6 \pm \sqrt{16}}{2}$$

$$x = \frac{6 \pm 4}{2}$$

$$x = \frac{6+4}{2} \quad \& \quad x = \frac{6-4}{2}$$

$$x = \frac{10}{2} \quad x = \frac{2}{2}$$

$$x = 5 \quad x = 1$$

$$\begin{aligned} \text{d) } 1-x &= 0.5x^2 \\ 0 &= 0.5x^2 + x - 1 \\ a &= 0.5; b = 1; c = -1 \end{aligned}$$

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

$$x = \frac{-1 \pm \sqrt{(1)^2 - 4(0.5)(-1)}}{2(0.5)}$$

$$x = \frac{-1 \pm \sqrt{1+2}}{1}$$

$$x = -1 \pm \sqrt{3}$$

$$x = -1 \pm \sqrt{3}$$

$$e) \quad 2-x = x^2+x$$

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

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

$$a=1; b=2; c=-2$$

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

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

$$x = \frac{-2 \pm \sqrt{4+8}}{2}$$

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

$$x = \frac{-2 \pm \sqrt{4 \times 3}}{2}$$

$$x = \frac{-2 \pm 2\sqrt{3}}{2}$$

$$x = -1 \pm \sqrt{3}$$

$$\begin{aligned}
 f) \quad 6(2-x) &= 3x^2 + 6x \\
 12 - 6x &= 3x^2 + 6x \\
 0 &= 3x^2 + 6x + 6x - 12 \\
 0 &= 3x^2 + 12x - 12 \\
 a &= 3; \quad b = 12; \quad c = -12
 \end{aligned}$$

$$\begin{aligned}
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 x &= \frac{-12 \pm \sqrt{(12)^2 - 4(3)(-12)}}{2(3)} \\
 x &= \frac{-12 \pm \sqrt{144 + 144}}{6} \\
 x &= \frac{-12 \pm \sqrt{288}}{6} \\
 x &= \frac{-12 \pm \sqrt{144 \times 2}}{6} \\
 x &= \frac{-12 \pm 12\sqrt{2}}{6} \\
 x &= \frac{-2 \pm 2\sqrt{2}}{1} \\
 x &= -2 \pm 2\sqrt{2}
 \end{aligned}$$