Section 1: Solving Quadratic Equations involving Proportions

1) $\frac{x}{16} = \frac{9}{x}$

$x \cdot x = 9 \cdot 16$

$x^2 = 144$

$x = \pm\sqrt{144}$

$x = 12$ OR $x = -12$

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2) $\frac{x}{20} = \frac{5}{x}$

$x^2 = 5 \cdot 20$

$x^2 = 100$

$x = \pm\sqrt{100}$

$x = \pm 10$

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3) $\frac{4x}{27} = \frac{3}{x}$

$4x^2 = 3 \cdot 27$

$\frac{4x^2}{4} = \frac{81}{4}$

$x^2 = 20.25$

$x = \pm\sqrt{20.25}$

$x = \pm 4.5$

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4) $\frac{9x}{36} = \frac{4}{x}$

$\frac{9x^2}{9} = \frac{144}{9}$

$x^2 = \frac{144}{9}$

$x = \pm\sqrt{\frac{144}{9}}$

$x = \pm\frac{12}{3}$

$x = \pm 4$

I decided to leave it as a fraction. You can get a decimal like here

Solve each Proportion.

5) $\frac{x-2}{8} = \frac{3}{x}$

$x^2 - 2x = 3 \cdot 8$

$x^2 - 2x = 24$

$x^2 - 2x - 24 = 0$

$(x-6)(x+4) = 0$

$x = 6, x = -4$

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6) $\frac{x+3}{10} = \frac{1}{x}$

$x^2 + 3x = 10$

$-10 \quad -10$

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

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

$x = -5, \quad x = 2$

$-10 = 1 \cdot -10$

$2 \cdot 5$

$x = -5$

$\frac{-5+3}{10} \stackrel{?}{=} \frac{1}{-5}$

$\frac{-2}{10} = \frac{1}{-5}$ ✓

$x = 2$

$\frac{2+3}{10} \stackrel{?}{=} \frac{1}{2}$

$\frac{5}{10} = \frac{1}{2}$ ✓

7) $\frac{x-2}{x-1} \not= \frac{x+4}{2x+2}$

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

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

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

$-x^2 -3x +4 \quad -x^2 -3x +4$

$x^2-5x=0$

$x(x-5)=0 \longrightarrow x=0, x=5$

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8) $\frac{x-1}{2x+3} \not= \frac{x-5}{3}$

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

F O I L

$3x-3 = 2x^2-10x+3x-15$

$-3x+3 \quad -3x+3$

$0 = 2x^2-10x-12$

$\frac{0}{2} = \frac{2x^2-10x-12}{2}$

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

$(x-6)(x+1)$

$x=6, x=-1$

Section 2: Solving Quadratic Equations involving Word Problems

Example 9: Solve.

The square of a number increased by twice the number is 48. Find both solutions.

"2" "x" "+" "times 2" "x" "="

$$x^2 + 2x = 48$$
$$-48 \quad -48$$
$$x^2 + 2x - 48 = 0$$
$$(x+8)(x-6) = 0$$
$$x = -8 \quad x = 6$$

Practice: Solve.

1) When 10 is subtracted from the square of a number the result is three times the number. What is the positive solution?

$$x^2 - 10 = 3 \cdot x$$
$$x^2 - 3x - 10 = 0$$
$$(x-5)(x+2) = 0$$
$$x = 5, \quad x = -2$$

So $x = 5$.