Full credit will only be awarded for all work shown in a neat and organized manner.

1. Solve using the quadratic formula. Simplify your answer as much as you can (*answer exactly*).

a. $-5x^2 + 9x - 3 = 0$

$a = -5$, $b = 9$, $c = -3$

$$x = \frac{-9 \pm \sqrt{9^2 - 4(-5)(-3)}}{2(-5)} = \frac{-9 \pm \sqrt{81 - 60}}{-10} = \frac{9 \pm \sqrt{21}}{10}$$

b. $\frac{1}{3}x^4 - 5x^2 - 42 = 0$ let $x^2 = z$

$\frac{1}{3}z^2 - 5z - 42 = 0$

$a = \frac{1}{3}$, $b = -5$, $c = -42$

$$z = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(\frac{1}{3})(-42)}}{2(\frac{1}{3})} = \frac{5 \pm \sqrt{25 + 56}}{(2/3)}$$

$$z = \frac{5 \pm \sqrt{81}}{2/3} = (5 \pm 9) \cdot \frac{3}{2} \Rightarrow \frac{3}{2}(14) = 21 \text{ or } \frac{3}{2}(-4) = -6$$

$x^2 = 21$ or $x^2 = -6$

$x = \pm\sqrt{21} \approx \pm 4.583$ $\quad x = \pm\sqrt{-6}$ ← undefined

NO Solutions here

Check: $x = 4.583$

$\frac{1}{3}(4.583)^4 - 5(4.583)^2 - 42 = 0$

$0.035 \approx 0$ close enough

$x = -4.583$

$\frac{1}{3}(4.583)^4 - 5(-4.583)^2 - 42 = 0$

$0.035 \approx 0$ close enough

$x = \pm\sqrt{21}$

c. $\left(\sqrt{7x^2 - 20x}\right)^2 = (5 - 2x)^2$

$7x^2 - 20x = (5 - 2x)(5 - 2x)$

$7x^2 - 20x = 25 - 10x - 10x + 4x^2$

$7x^2 - 20x = 25 - 20x + 4x^2$

$3x^2 - 25 = 0$ $\quad a = 3$, $b = 0$, $c = -25$

$$x = \frac{-0 \pm \sqrt{(0)^2 - 4(3)(-25)}}{2(3)}$$

$$x = \frac{\pm\sqrt{300}}{6} \approx \pm 2.887$$

Check: $x = 2.887$

$\sqrt{7(2.887)^2 - 20(2.887)} = 5 - 2(2.887)$

$0.777 \neq -0.774$

$\frac{\sqrt{300}}{6}$ is not a Solution

$x = -2.887$

$\sqrt{7(-2.887)^2 - 20(-2.887)} = 5 - 2(-2.887)$

$10.774 = 10.774$ ✓

Only $x = \frac{-\sqrt{300}}{6}$ is a Solution

2. For what value(s) of p will the quadratic equation $px^2 + 6x + 14 = 0$ have:

i. One solution ii. 2 solutions iii. No solutions

$D = b^2 - 4ac = 6^2 - 4(p)(14) = 36 - 56p$

i) $36 - 56p = 0$ $\quad 36 = 56p$ $\quad p = \frac{9}{14}$

ii) $36 - 56p > 0$ $\quad 36 > 56p$ $\quad \frac{9}{14} > p$

iii) $36 - 56p < 0$ $\quad 36 < 56p$ $\quad \frac{9}{14} < p$

b. What are the overall dimensions of the frame and picture together *(answer to 1 decimal place)*?

$\frac{\text{Area Picture}}{\text{Area frame + Picture}} = \frac{12 \cdot 15 = 180}{180 \cdot 1.5 = 270 = (12+2x)(15+2x)}$

$270 = 180 + 30x + 24x + 4x^2$

$0 = 4x^2 + 54x - 90$

$a = 4$, $b = 54$, $c = -90$

$x = \frac{-54 \pm \sqrt{(54)^2 - 4(4)(90)}}{2(4)}$

$= \frac{-54 \pm \sqrt{4356}}{8} = \frac{-54 \pm 66}{8} = -\cancel{15}$ (no neg), 1.5

a) width = 1.5cm

b) Dimensions: $(12+2(1.5)) \times (15+2(1.5))$

15cm × 18cm

4. Mr. G is driving up to Whistler for the weekend which is 120km away. On the way back, he drives 5km/h slower and it takes 9 minutes longer than the way up to Whistler. *(Answer to 2 decimal places)*
   a. How fast did he drive on the way up to Whistler?
   b. How long did it take him to get home from Whistler?

	Dist	Speed	time
there	120km	x	t
back	120km	$x-5$ km/h	$t + \cancel{9\text{min}}\ \frac{9}{60} = 0.15$
			$t + 0.15$

$D = S \cdot t$

$120 = x \cdot t \rightarrow t = \frac{120}{x}$

$120 = (x-5)(t+0.15)$

$120 = (x-5)\left(\frac{120}{x} + 0.15\right)$

$120 = x \cdot \frac{120}{x} - 5 \cdot \frac{120}{x} + x \cdot (0.15) - 5 \cdot (0.15)$

$120 = \cancel{120} - \frac{600}{x} + 0.15x - 0.75$

$x \cdot 0 = \left(-\frac{600}{x} + 0.15x - 0.75\right) \cdot x$

$0 = -600 + 0.15x^2 - 0.75x$

$a = 0.15$, $b = -0.75$, $c = -600$

$x = \frac{-(-0.75) \pm \sqrt{(0.75)^2 - 4(0.15)(600)}}{2(0.15)}$

$x = \frac{0.75 \pm \sqrt{0.5625 + 360}}{0.3}$

$x = 65.8, -60.8$

a) Speed = 65.79 km/h

b) $120 = (65.79) \cdot t$

$t = \frac{120}{65.79} = 1.82\text{h}$

$t_{back} = 1.82 + 0.15 = 1.97$

$t_{back} = 1.97\text{hours}$