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

1. Given the parabola: $f(x) = \frac{1}{4}x^2 + 3x - 10$
   a. Find the axis of symmetry of $f(x)$ by completing the square (*no shortcut allowed!*)
   b. Find the x-intercepts of $f(x)$ (*give exact answers*)

a) $= \frac{1}{4}\left[(x^2 + 12x + k) - k\right] - 10$

$\left(\frac{1}{2}(12)\right)^2 = (6)^2 = 36$

$= \frac{1}{4}\left[(x^2 + 12x + 36) - 36\right] - 10$

$= \frac{1}{4}\left[(x+6)^2 - 36\right] - 10 = \frac{1}{4}(x+6)^2 - 9 - 10$

$= \frac{1}{4}(x+6)^2 - 19$

$h = -6$ $\boxed{x = -6}$

b) $\frac{1}{4}(x+6)^2 - 19 = 0$

$\frac{1}{4}(x+6)^2 = 19$

$(x+6)^2 = 76$

$x + 6 = \pm\sqrt{76}$

$x = -6 \pm \sqrt{76}$

$\boxed{(-6 \pm \sqrt{76}, 0)}$

2. Given the parabola: $f(x) = 3x^2 + 6x - 4$
   a. Find the vertex of $f(x)$ (shortcut is allowed)
   b. Find the x-intercepts **and** y-intercept of $f(x)$ (*give exact answers*)
   c. Sketch *f(x)* on the grid provided, plotting all intercepts and vertex

a. vertex: $(-1, -7)$

b. y-int: $(0, -4)$

x-int(s): $(-1 \pm \sqrt{\frac{7}{3}}, 0)$

a) $h = \frac{-b}{2a} = \frac{-6}{2(3)} = \underline{-1}$

$f(-1) = k = 3(-1)^2 + 6(-1) - 4$

$= 3 - 6 - 4 = \underline{-7}$

b) $f(x) = 3(x+1)^2 - 7 = 0$

$3(x+1)^2 = 7$

$(x+1)^2 = \frac{7}{3}$

$x + 1 = \pm\sqrt{\frac{7}{3}}$

$x = -1 \pm \sqrt{\frac{7}{3}}$

$\approx 0.5, -2.5$

$f(0) = 3(0+1)^2 - 7$

$= 3(1)^2 - 7$

$= 3 - 7$

$= -4$

3. Mr. Johnston is deciding on a price for Byng Wear sweaters. He is currently selling them for $52 each and 70 students have ordered them. A survey tells him that by decreasing the price by $2, 5 more students would purchase the sweater. If Mr. Johnston wants to maximize income,
   a. what price should he sell the sweater?
   b. how much total income will he earn?

x = # of times the price decreased

$$\text{Income} = \text{Price} \cdot \#\text{ of Students}$$

$$= (52-2x)\cdot(70+5x)$$

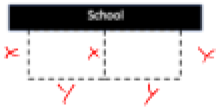
$$= 3640 - 140x + 260x - 10x^2 = 3640 + 120x - 10x^2$$

$$h = \frac{-b}{2a} = \frac{-120}{2(-10)} = \underline{6} \leftarrow x \text{ value at max income}$$

a) $\text{price} = 52 - 2(6) = \boxed{\$40}$

b) $\text{Income} = (40)\cdot(70+5(6)) = 40 \cdot 100 = \boxed{\$4000}$

4. Lord Byng is constructing a garden next to the school. The garden will have two identical rectangular sections, divided and surrounded by a fence, as shown below. No fencing is needed against the school. If Lord Byng has 300m of fencing to use:
   a. what is the **total** maximum area that can be enclosed?
   b. what are the dimensions of the **total enclosed area**?



$$A = x \cdot 2y \qquad 3x + 2y = 300$$

$$2y = 300 - 3x$$

$$y = \frac{300-3x}{2}$$

$$A = x \cdot 2\left(\frac{300-3x}{2}\right)$$

$$A = x(300-3x)$$

$$= 300x - 3x^2$$

$$h = \frac{-b}{2a} = \frac{-300}{2(-3)} = \underline{50\text{m}} \leftarrow x \text{ value at max area}$$

$$y = \frac{300-3(50)}{2} = \frac{150}{2} = \underline{75\text{m}}$$

a) $A = (50)\cdot 2(75) = 50 \cdot 150 = \boxed{7500\text{m}^2}$

b) $\boxed{50\text{m} \times 150\text{m}}$