Week 2

1.1 | 4, 24, 52

4 | Solutions vary

24 | Evaluate $\frac{f(a+h)-f(a)}{h}$ if $f(x)=x^3$.

$$\frac{f(a+h)-f(a)}{h} = \frac{(a+h)^3 - a^3}{h} = \frac{a^3+3a^2h+3ah^2+h^3-a^3}{h}$$

$$= \frac{h(+3a^2+3ah+h^2)}{h} = \underline{3a^2+3ah+h^2}.$$

52 | If a rectangle has area $16m^3$ has dimensions x and y, then

$$16 = xy, \text{ so } y = 16/x.$$

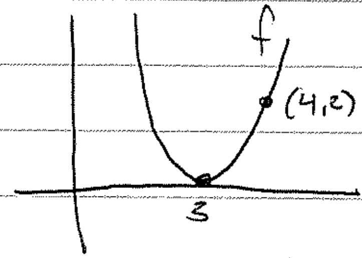
The perimeter of the rectangle is

$P = 2x+2y$. Substituting we find that

$P = 2x + 32/x$.

1.2 8, 10

8) Find an expression representing the quadratics shown:

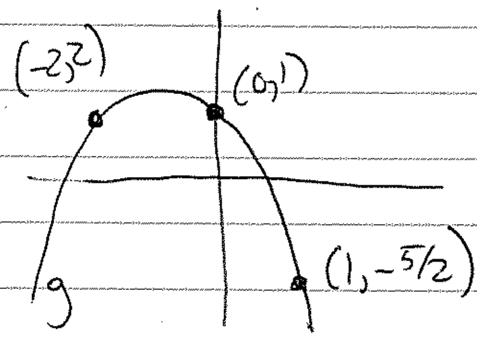
a) 

This has a double root, so has the form $f(x) = a(x-3)^2$ for some a.

Since $(4,2)$ is on the graph,

$$2 = a(4-3)^2, \text{ so } a = 2.$$

$$\underline{f(x) = 2(x-3)^2}$$

b) 

To solve this one, use a system of three linear equations w/ variables the coefficients:

$$g(x) = ax^2 + bx + c, \text{ so}$$

$$\begin{cases} 2 = 4a - 2b + c \\ 1 = c \\ -5/2 = a + b + c \end{cases}$$

(solve using any technique:

$$\begin{bmatrix} 4 & -2 & 1 & 2 \\ 2 & 2 & 2 & -5 \\ 0 & 0 & 1 & 1 \end{bmatrix} \sim \begin{bmatrix} 2 & 2 & 2 & -5 \\ 0 & -6 & -3 & 12 \\ 0 & 0 & 1 & 1 \end{bmatrix} \sim \begin{bmatrix} 2 & 2 & 0 & -7 \\ 0 & -6 & 0 & 15 \\ 0 & 0 & 1 & 1 \end{bmatrix}$$

$\downarrow$

So $c=1$, $b=-\frac{15}{6}=-\frac{5}{2}$ and (after some arithmetic), $a=-1$.

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

10) Studies show that ave. surface temp can be modeled by

$$T=0.02t+8.50$$

where T is temp in °C and t is the number of years since 1900.

a) The slope represents the rate of change of temperature with respect to time. The T intercept is what the model predicts for the ave. surface temp in 1900

b) In 2100, $t=200$, so

$$T=0.02\cdot 200+8.5=12.5°C.$$