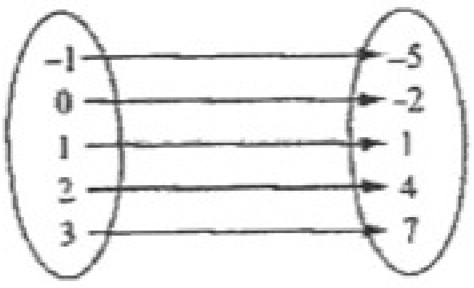
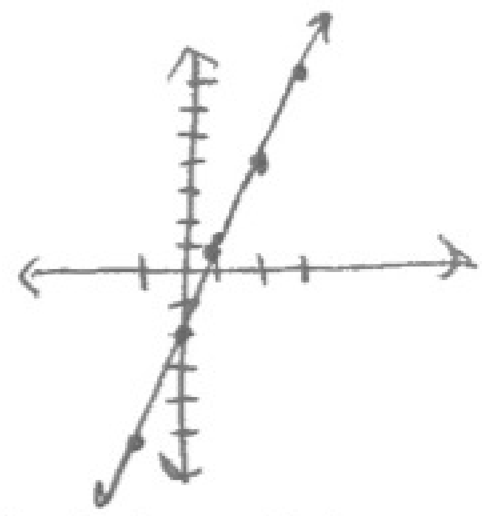
MSIB Worksheet: Functions (review and sine/cosine)

1. Suppose you are suspending weights from a spring. The length of the spring is a linear function of the amount of weight suspended from it.
   When a 20 g weight is attached to the spring, it stretches to 7.5 cm. (20, 7.5)
   When an 80 g weight is attached to the spring, it stretches to 15 cm. (80, 15)
   a) Write a function to represent the length of the spring with any weight w. $y = \frac{1}{8}x + 5$
   b) How long is the spring when no weight is attached to it? 5cm
   c) How long is the spring with a weight of 120 g?
   20cm

2. A linear function is represented by the following mapping diagram:



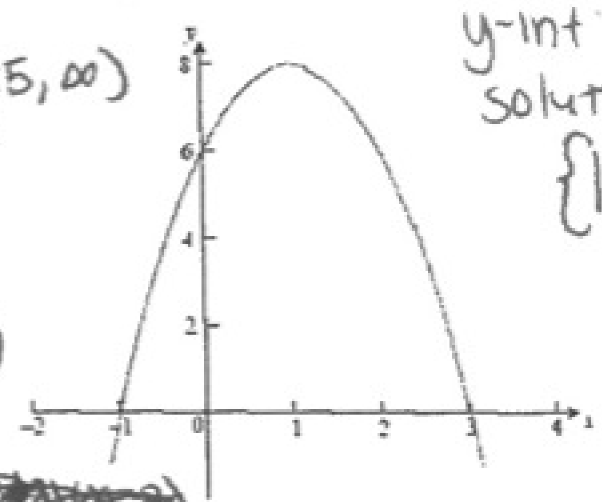


   a) Plot these points on a graph.
   b) Find the ~~slope~~ gradient of this line. $m=3$
   c) Find the equation of this function.
   $y=3x-2$

3. State the domain, range, vertex, axis of symmetry, and y-intercept and solutions of the function $f(x) = x^2 + x - 3$
   domain: $x = \mathbb{R}$ or $(-\infty, \infty)$
   a.o.s → $x = -\frac{1}{2}$
   vertex: (-0.5, -3.25)
   range: $y \geq -3.25$ OR $[-3.25, \infty)$
   y-int: (0, -3)
   solutions {1.30, -2.30}

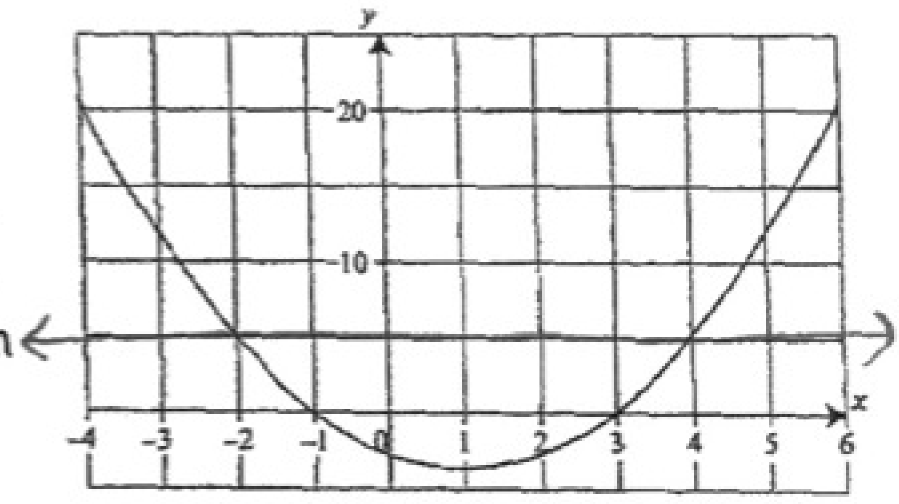
4. The figure to the right shows part of a quadratic function $y = ax^2 + 4x + c$.
   a) Write down the value of c. = 6
   b) Find the value of a. = -2
   c) Write the quadratic function in its factorised form. $y = -2(x-3)(x+1)$
   $y = -2x^2 + 4x + 6$

x^2+4x+6
$a(x-3)(x+1)$
se (0,6)
$a(0-3)(0+1)$
$= a(-3)(1)$
$= -2$



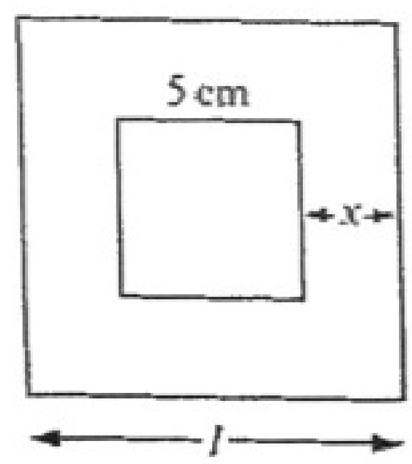
5. The graph of $y = x^2 - 2x - 3$ is shown on the axes below.

   a) Draw the graph of y = 5 on the same axes.
   b) Use your graph to find
      i) the values of x when $x^2 - 2x - 3 = 5$. $x = -2, 4$
      ii) the values of x when $x^2 - 2x - 3 = 0$. $x = -1, 3$
      iii) the value of x that gives the minimum value of $x^2 - 2x - 3$.
      $x = 1$

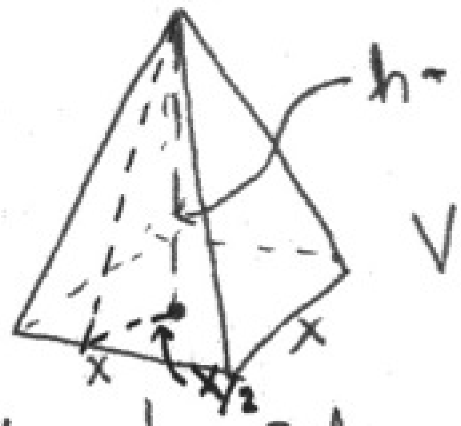


6. Find the solutions of the equation $x^2 - 5x = 24$.
   $x = -3, 8$

7. A picture is in the shape of a square of side 5 cm. It is surrounded by a wooden frame of width x cm, as shown in the diagram.
   The length of the wooden frame is l cm, and the area of the wooden frame is A cm^2.



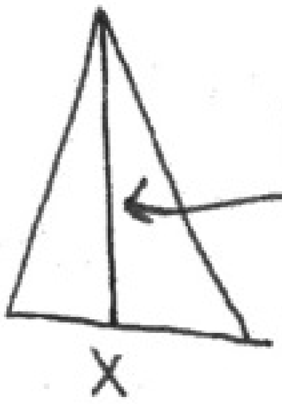
   a) Write an expression for the length l in terms of x. $l = 2x+5$
   b) Write an expression for the area A in terms of x. $A = (2x+5)^2 - 25$
   c) If the area of the frame is 24 cm^2, find the value of x. Write the equation and sketch the graph you used to solve this.
   $24 = (2x+5)^2 - 25$
   $\pm\sqrt{49} = \sqrt{(2x+5)^2}$
   $2x+5 = \pm 7$
   $x = 1, \cancel{-6}$



$V = 1500 m^3$

a) $V = \frac{1}{3}x^2 h$

b)



$a^2 + b^2 = c^2$

$h^2 + \left(\frac{x}{2}\right)^2 = c^2$

$c = \sqrt{h^2 + \left(\frac{x}{2}\right)^2}$

c) $T = \square + 4\Delta$'s

$T = x^2 + 4\left[\frac{1}{2}(x)\left(\sqrt{h^2 + \left(\frac{x}{2}\right)^2}\right)\right]$

$T = x^2 + 2x\sqrt{h^2 + \left(\frac{x}{2}\right)^2}$

d) $3(1500) = \left(\frac{1}{3}x^2 h\right)3$

$\frac{4500}{x^2} = \frac{\cancel{x^2} h}{\cancel{x^2}}$

$h = \frac{4500}{x^2}$

$T = x^2 + 2x\sqrt{\left(\frac{4500}{x^2}\right)^2 + \left(\frac{x}{2}\right)^2}$

e) Calculator Window suggestion →

Xmin = 0
Xmax = 30
Xscl = 1
Ymin = 0
Ymax = 5000
Yscl = 100

f) side length = 14.7 m
height = 20.8 m