

1) A rock is thrown upward from the edge of a 50 m cliff overlooking Lake Superior, with an initial velocity of 17.2 m/s.

$$h = -\frac{1}{2}gt^2 + v_0t + h_0, \text{ where } g = 9.8\text{m/sec}^2$$

a) Write an equation that models the height  $h$  of the rock in terms of time  $t$ .

$$h = -\frac{1}{2}(9.8)t^2 + 17.2t + 50$$

$$\boxed{h = -4.9t^2 + 17.2t + 50}$$

b) Predict the height of the rock at 4 seconds.

$$h = -4.9(4)^2 + 17.2(4) + 50$$

$$\boxed{h = 40.4\text{m}}$$

c) At what time will the rock hit the ground?

$$0 = -4.9t^2 + 17.2t + 50$$

$$a = -4.9 \quad b = 17.2 \quad c = 50$$

$$X = \frac{-17.2 \pm \sqrt{(17.2)^2 - 4(-4.9)(50)}}{2(-4.9)}$$

$$X = \frac{-17.2 \pm \sqrt{1275.84}}{-9.8}$$

$X = -1.89 \text{ sec invalid}$

$$\boxed{X = 5.40 \text{ sec}}$$

2) A parabola contains the points  $(-2, -7), (1, 8), (2, 21)$

$$y = ax^2 + bx + c$$

a) Set up the system of equations.

$$\begin{aligned} -7 &= a(-2)^2 + b(-2) + c & \rightarrow -7 &= 4a - 2b + c \\ 8 &= a(1)^2 + b(1) + c & \rightarrow 8 &= 1a + 1b + c \\ 21 &= a(2)^2 + b(2) + c & \rightarrow 21 &= 4a + 2b + c \end{aligned}$$

b) Write the matrix equation.

$$\begin{bmatrix} 4 & -2 & 1 \\ 1 & 1 & 1 \\ 4 & 2 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} -7 \\ 8 \\ 21 \end{bmatrix}$$

$[A] \quad [x] \quad [B]$

c) Solve the matrix equation. Write the equation for the parabola.

$$[x] = [A]^{-1}[B]$$

$$\boxed{y = 2x^2 + 7x - 1}$$

$$[x] = \begin{bmatrix} 2 \\ 7 \\ -1 \end{bmatrix} \begin{matrix} \rightarrow a \\ \rightarrow b \\ \rightarrow c \end{matrix}$$