X – Intercepts Part 2

Determining the vertex from standard form:

\[ y = x^2 + x - 2 \]
\[ y = (x+2)(x-1) \]
\[ x = \frac{-2 + (1)}{2} \]
\[ x = -0.5 \]
\[ y = (-0.5)^2 + (-0.5) - 2 \]
\[ y = -1.25 \]
\[ \text{c) } y = 2x^2 + 16x + 30 \]

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]
\[ x = \frac{-6 + \sqrt{36 - 4(2)(30)}}{4} \]
\[ x = 0 \]
\[ y = (0)^2 - 36 \]
\[ y = -36 \]

Solve by Factoring:

When you are asked to solve a quadratic it means you are solving for the value of x.

To solve it needs to be equal to 0 and then you solve by factoring. (Remember once it is factored the solutions are the opposite sign of what is in brackets.)

\[ a) \quad x^2 + 7x + 12 = 0 \quad M: 12 \quad N: -4, -3 \]
\[ (x+4)(x+3) = 0 \quad A: 7 \]
\[ x = -4 \]
\[ x = -3 \]

\[ b) \quad 3x^2 + 9x - 6 = 0 \quad M: 2 \quad N: -3, 1 \]
\[ 3(x^2 + 3x + 2) = 0 \quad A: 3 \]
\[ 3(x+2)(x+1) = 0 \quad N: -3, 1 \]
\[ x = -2 \]
\[ x = -1 \]

\[ c) \quad 5x^2 - 20x = 300 \]
\[ (x^2 - 4x - 60) = 0 \quad M: 60 \quad N: 4 \]
\[ 5x(x - 6) = 0 \quad A: -4 \]
\[ 5(x + 6)(x - 10) = 0 \quad N: 6, -10 \]
\[ x = -6 \]
\[ x = 10 \]
Applications/Problem Solving

Example 1:
A bottle rocket is fired from the ground. Its height (in m) is given by
\[ h = -5t^2 + 30t \]
where \( t \) (in seconds) is the time since the object was fired.

a) How **high** is the rocket at \( t = 2s \)?

\[ h = -5(2)^2 + 30(2) \]
\[ h = 40 \text{ m} \]

b) **When** is the rocket on the ground?

\[ 0 = -5t^2 + 30t \]
\[ 0 = -5(t^2 - 6t) \]
\[ t = 0, 6 \text{ sec} \]

\( t = 6 \text{ sec} \) is the time at which the rocket is on the ground.


c) **When** is the rocket 25 m off the ground?

\[ 25 = -5t^2 + 30t \]
\[ 0 = -5t^2 + 30t - 25 \]
\[ 0 = -5(t^2 - 6t + 5) \]
\[ 0 = -5(t-5)(t-1) \]

The rocket is 25 m off the ground when \( t = 5 \text{ sec} \).


d) What is the **maximum height** of the object?

\[ x = 0 + \frac{b}{2} \]
\[ x = 3 \]
\[ h = -5(3)^2 + 30(3) \]
\[ h = 45 \text{ m} \]

\[ h = a(x-h)^2 + k \]
\[ h = -5(x-3)^2 + 45 \]

\[ : \text{maximum height is 45m} \]

e) Write the equation in vertex form.
Example 2 Problem Solving
1. A bungy jumper leaps from a bridge above a lake. Her height in meters, measured from the surface of the water, is given by $h = 4t^2 - 32t + 60$, where $t$ is in seconds.
   a) How high did she jump from? (Hint: What is the time when she jumps?)

   $\text{initial value} \quad \boxed{60 \text{m}}$

b) When is the jumper's height 12 m above the water?

   $12 = 4t^2 - 32t + 60$
   $0 = 4t^2 - 32t + 48$
   $0 = 4(t^2 - 8t + 12)$
   $t = 2 \text{ sec}$
   $t = 6 \text{ sec}$
   $t = 12 \text{ sec}$

   $M: 12$
   $A: -8$
   $N: -2, -6$

   $O: 4(t - 2)(t - 6)$
   $N: -5, -3$

   $t = 2 \text{ sec}$
   $t = 6 \text{ sec}$

   $M: 15$
   $A: -8$
   $N: -5, -3$

   $d) \text{ When is she at the deepest point?}$

   $x^\prime \text{ of the vertex.}$
   $t = \frac{3 + 5}{2}$
   $x = 4 \text{ sec}$

   $t = 5 \text{ sec}$

   $e) \text{ What is the deepest she goes into the water?}$

   $h = 4(4)^2 - 32(4) + 60$
   $h = -4 \text{ m under water}$

   $f) \text{ Express } h = 4t^2 - 32t + 60 \text{ in vertex form.}$

   $h = 4(t - 4)^2 - 4$