

### 3.5 More Problem Solving

Given Standard form of an equation, what do you when....

...you are asked to find when an object lands, break even point...  
(ie find the roots/zeros/x int, solve).

Two methods:

1. Quadratic formula (works every time)
2. Factor and set factors to zero

...you are asked to find the Max/Min  
and when it occurs

Two methods:

1. Complete the square to vertex form
2. Factor, find zeros, find x half way  
between zeros, sub back in for y

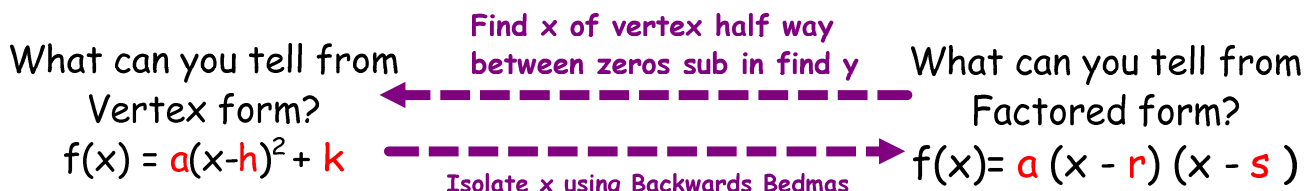
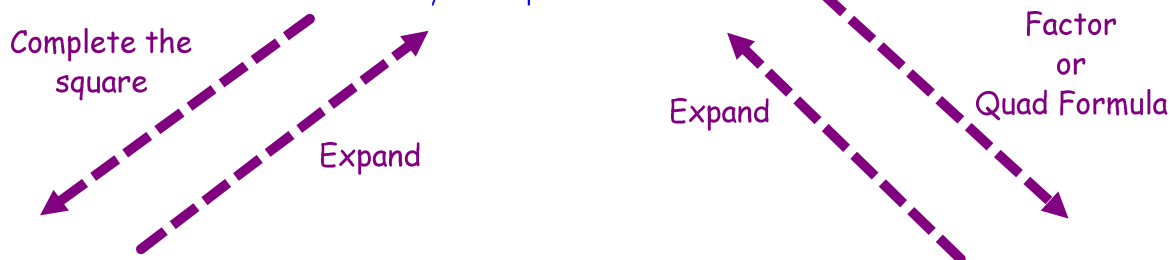
Mind Map...

Recall: What we know when given equations in various forms

What can you tell from standard form?

$$f(x) = ax^2 + bx + c$$

- direction of opening and stretch  $a$
- the  $y$  intercept  $c$



What can you tell from Vertex form?

$$f(x) = a(x-h)^2 + k$$

- direction of opening and stretch  $a$
  - the vertex  $(h,k)$
  - max/min & when it occurs
- Can find:
- the zeros (set = to 0 and solve for  $x$  using backward BEDMAS)
  - $y$ -intercept  $f(0)$

What can you tell from Factored form?

$$f(x) = a(x-r)(x-s)$$

- direction of opening and stretch  $a$
  - the zeros  $r$  and  $s$
- Can find:
- vertex (half way between the zeros)
  - $y$ -intercept  $f(0)$

What order will you do these questions in?

What method(s) will you use?

Get into groups of 4 and try and answer these questions using different orders and methods

Ex.1 The height of an object thrown off a tower is given by  $h = -5t^2 + 35t + 90$ , where  $h$  is the height above the ground in metres and  $t$  is the time in seconds.

What is the initial height of the object?

90 (see in std form)

What is the max height of the object?

Complete the square  
Read  $y$  from vertex  
= 151.25 m

When does the max height of the object occur?

Read  $x$  from vertex  
= 3.5 s

How long does it take for the object to hit the ground?

factor from std.

$$~~t = -2~~$$

$$t = 9$$

$\therefore$  Hits the ground in 9 seconds

Ex 2

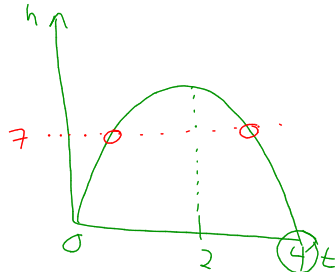
The height of the football kicked from the ground is given by the function  $h(t) = -5t^2 + 20t$  where  $h(t)$  is the height in meters and  $t$  is the time in seconds.

Which do I answer first?

When will the football reach its maximum height?  
 What is the maximum height? } Vertex!

$$\begin{aligned}
 h(t) &= -5t^2 + 20t \\
 &= -5(t^2 - 4t + 4 - 4) && (2, 20) \\
 &= -5(t^2 - 4t + 4) + 20 && \therefore \text{Max height of} \\
 &= -5(t-2)^2 + 20 && \text{20m reached} \\
 &&& \text{@ 2s}
 \end{aligned}$$

State the domain and range as it applies to the situation.



$$D = \{0 \leq t \leq 4 \mid t \in \mathbb{R}\}$$

$$R = \{0 \leq h(t) \leq 20 \mid h(t) \in \mathbb{R}\}$$

For how long is the ball at or above 7m?

Set  $h(t) = 7$

$$7 = -5t^2 + 20t$$

$$0 = -5t^2 + 20t - 7$$

~~M 35~~  
~~A 20~~  
~~N~~

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t = \frac{-20 \pm \sqrt{20^2 - 4(-5)(-7)}}{2(-5)}$$

$$= \frac{-20 \pm \sqrt{260}}{-10}$$

$$t \approx 0.39 \quad \text{OR} \quad t \approx 3.61$$

How long?  
 $t = 3.61 - 0.39$   
 $= 3.22$

$\therefore$  At or above 7m  
 for approx. 3.22sec

Ex 3

The *Golden Gate Bridge*, in San Francisco is a suspension bridge supported by a pair of cables that appear to form parabolas. The cables are attached at either end to a pair of towers at points 152 m above the roadway.

The towers are 1280 m apart, and the cable reaches its lowest point when it is 4 m above the roadway.

a) Determine an algebraic expression that models the cable as it hangs between the towers.

b) What is the height of the cable 100 m from its lowest point?

Practice  
Complete other methods  
for example 3



p 162 # 8, 10, 12, 13

p142 # 17

p 169 #9-12

3.5 Handout *(On website)*

