Finding the Rule - Given the Zeros and a Point

What is the equation of the parabola whose zeros are -10 and 20 and passes through the point $(5,40)$?

Given the zeros, use factored form.

$$f(x) = a(x - x_1)(x - x_2)$$

$$f(x) = a(x + 10)(x - 20)$$

$$40 = a(5 + 10)(5 - 20)$$

$$40 = a(15)(-15)$$

$$40 = -225a$$

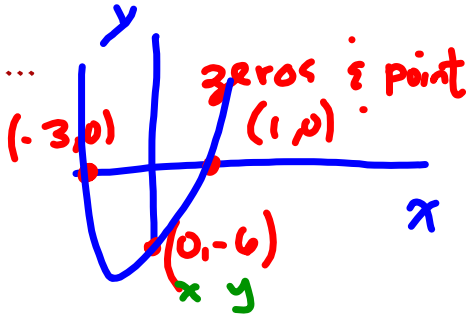
$$\frac{40}{-225} = -\frac{8}{45} = a$$

$$f(x) = -\frac{8}{45}(x + 10)(x - 20)$$

Determine the equation of the parabola whose intercepts are $(-3,0)$, $(1,0)$ and $(0,-6)$ ...

a) in general form

b) in standard form



We have the zeros and a point, so first we'll find the factored form and then convert.

$$f(x)=a(x+3)(x-1)$$

$$-6=a(3)(-1)$$

$$-6=-3a$$

$$a=2$$

$$f(x)=2(x+3)(x-1)$$

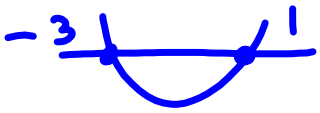
$x^2-x+3x-3$

a) Convert to general

$$f(x)=2(x^2+2x-3)$$

$$f(x)=2x^2+4x-6$$

b) We can use the zeros to find h.



$$h = \frac{x_1 + x_2}{2} = \frac{-3+1}{2} = -1$$

Let $x = -1$ to find k.

$$f(-1) = 2(-1+3)(-1-1)$$

$$k = 2(2)(-2) = -8$$

Standard form

$$f(x) = 2(x+1)^2 - 8$$

2. As a function of time t, the depth which a beluga whale dives below the surface of the water is given by the rule : $d(t)=\frac{1}{2}t(t-12)$

where t represents the time in seconds and $d(t)$ the depth in metres. Luke is watching one of these mammals prepare to dive.

a) After how many seconds will the beluga reach its maximum depth ?

b) What is the maximum depth reached by the whale?

c) For how many seconds was the beluga lower than 10m below the surface?

$a(x-x_1)(x-x_2)$ $a(t-t_1)(t-t_2)$

$d(t) = \frac{1}{2}t(t-12)$ zeros : $\{0, 12\}$

$t_1 = 0$

a) After how many seconds will the beluga reach its maximum depth ?

at vertex $h = \frac{0+12}{2} = \frac{12}{2} = 6s$

b) What is the maximum depth reached by the whale? $18m$

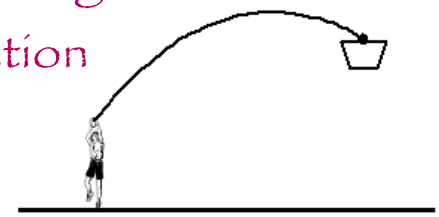
$d(6) = \frac{1}{2}(6)(6-12)$

$= \frac{1}{2}(6)(-6)$

$= -18$

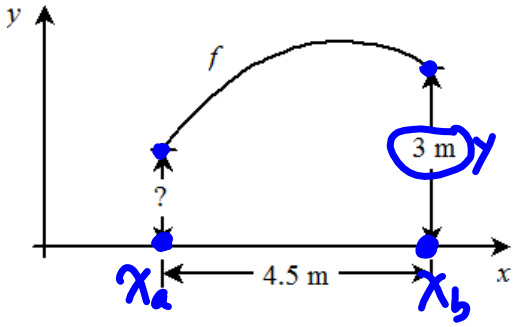
Caroline throws a ball toward a basket located $3m$ above the ground, as shown in the diagram.

The rule associated with this function is $f(x) = -0.2(x-5)^2 + 3.45$



The horizontal distance between Caroline and the location of the basket is $4.5m$.

At what height does Caroline throw the ball ?



$$f(x) = -0.2(x-5)^2 + 3.45$$

① let $y = 3$

$3 = -0.2(x-5)^2 + 3.45$

$-3.45 \quad -3.45$

$-0.45 = -0.2(x-5)^2$

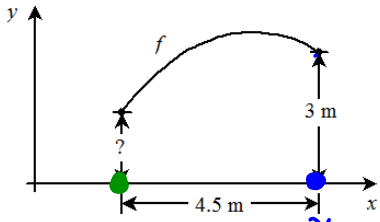
$2.25 = (x-5)^2$

$\pm 1.5 = x - 5$

$\pm 1.5 + 5 = x$

$\{3.5, 6.5\} = x$

$6.5 > 5$ ⑤ $\quad x < 6.5$



② $x = 6.5 - 4.5$

$= 2$

③ let $x = 2$

$f(2) = -0.2(2-5)^2 + 3.45$

$= -0.2(-3)^2 + 3.45$

$= -0.2(9) + 3.45$

$= -1.8 + 3.45$

1.65m