

4.3 * Finding The Equation of A Parabola *

Warmup The height of a golf ball, h meters, depending on time, t seconds, is calculated using the formula $h = -4(t-3)^2 + 40$.

a) Find the maximum height of the ball.

Sol'n \therefore Vertex is $(3, 40)$
 \uparrow max value

\therefore Max height = 40 meters.

b) How high was ball when it was hit?

Sol'n Sub in $t=0$ and solve for h .

$$\begin{aligned} h &= -4(t-3)^2 + 40 \\ h &= -4(0-3)^2 + 40, \text{ sub in} \\ &= -4(-3)^2 + 40 \\ &= -4(9) + 40, \text{ squared 3} \\ &= -36 + 40, \text{ multiply} \\ &= 4 \end{aligned}$$

\therefore Golf ball was 4m above ground zero.

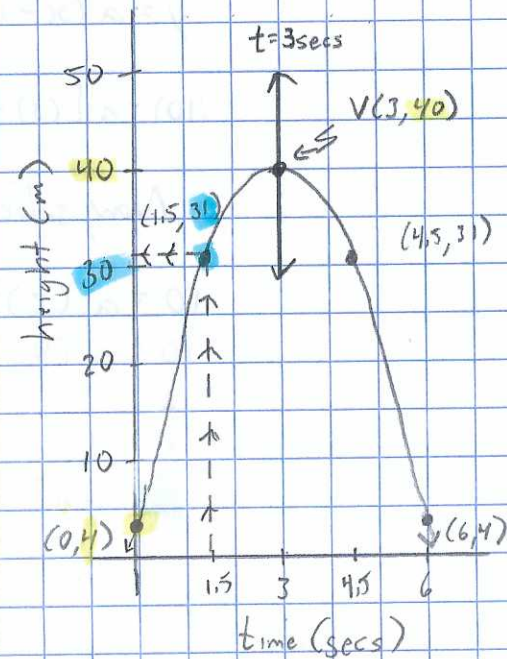


c) How high was ball after 1.5 seconds?

Sol'n Sub in $t=1.5$ seconds and solve for h .

$$\begin{aligned} h &= -4(t-3)^2 + 40 \\ h &= -4(1.5-3)^2 + 40 \\ &= -4(-1.5)^2 + 40, \text{ Brackets first} \\ &= -4(2.25) + 40, \text{ Square} \\ &= -9 + 40 \\ &= 31 \end{aligned}$$

\therefore Ball was 31m above ground 1.5 seconds into its flight.



Ex₁ Write the equation for the parabola with vertex (3, 2) and passing through point (5, 10).

Sol₁

$$y = a(x-p)^2 + q, \text{ vertex form formula}$$

$$y = a(x-(3))^2 + 2, \text{ sub in vertex } (3, 2) = (p, q)$$

$$(10) = a[(5)-(3)]^2 + 2, \text{ sub in point } (5, 10) \text{ for } (x, y)$$

Now, solve for a.

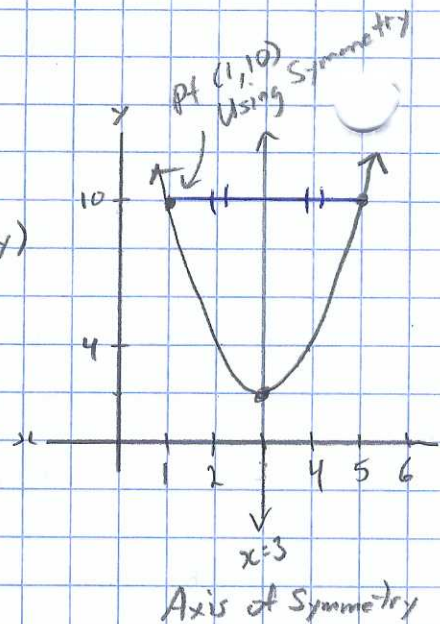
$$10 = a(2)^2 + 2$$

$$10 = a(4) + 2$$

$$-2 = 4a$$

$$\text{So } 2 = a$$

$$\therefore \text{Equation is } y = 2(x-3)^2 + 2$$



Ex₂ Write the equation of the parabola with vertex (-2, -4) and a y-intercept of -20.

Sol₂

$$y = a(x-p)^2 + q$$

$$y = a(x-(-2))^2 + (-4), \text{ sub in vertex}$$

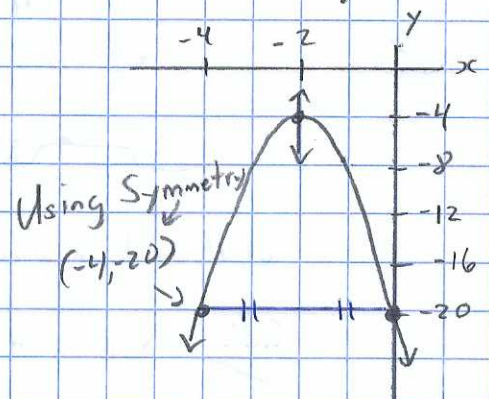
$$(-20) = a[(0)-(-2)]^2 + (-4), \text{ sub in } x=0$$

$$-20 = a(2)^2 - 4, \text{ tidy up double signs}$$

$$-16 = a(2)^2$$

$$-16 = a(4)$$

$$\therefore -4 = a, \text{ divide by 4.}$$



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#24
#26 ab

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Desmos Activity 4