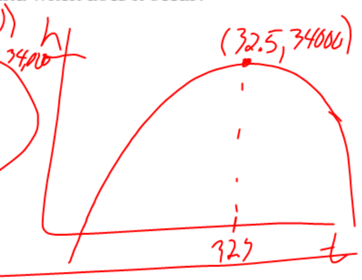
50. AEROSPACE NASA's KC135A aircraft flies in parabolic arcs to simulate the weightlessness experienced by astronauts in space. The height h of the aircraft (in feet) t seconds after it begins its parabolic flight can be modeled by the equation $h(t) = -9.09(t - 32.5)^2 + 34{,}000$. What is the maximum height of the aircraft during this maneuver and when does it occur?

Vertex $(32.5, 34{,}000)$

max: 34,000 ft
32.5 sec



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$$y = 4x^2 + 24x$$

$y = 4(x^2 + 6x + 9) - 9(4)$

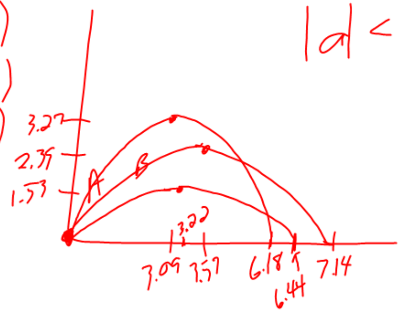
$\frac{6}{2} = 3$
$3^2 = 9$

$$\boxed{y = 4(x+3)^2 - 36}$$

vertex $(-3, -36)$
axis: $x = -3$
opens: up

A (3.09, 3.27)
B (3.57, 2.39)
C (3.22, 1.53)

$|a| < 1$



$(2, -1)$

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

$y = -?(x-2)^2 - 1$

Product Property

$x^m \cdot x^n = x^{m+n}$ $\qquad x^7 \cdot x^{-3} = x^4$

Quotient Property

$\frac{x^m}{x^n} = x^{m-n}$ $\qquad \frac{x^5}{x^3} = \frac{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}\cdot x\cdot x}{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}} = x^2$

$\frac{x^3}{x^5} = x^{-2} = \frac{1}{x^2}$

$\frac{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}}{\cancel{x}\cdot\cancel{x}\cdot\cancel{x}\cdot x\cdot x}$

Negative exponents

$x^{-m} = \frac{1}{x^m}$ $\qquad 2x^{-3} = \frac{2}{x^3}$

or

$\frac{1}{x^{-m}} = x^m$ $\qquad \frac{1}{x^{-4}} = x^4$

Power of a power

$(x^m)^n = x^{mn}$ $\qquad (x^5)^3 = x^{15}$

Power of a product

$(xy)^m = x^m y^m$ $\qquad (x^2y^3)^4 = (x^2)^4(y^3)^4 = x^8y^{12}$