Read
"Scaling Problems" class web page
3.1 - 3.2

H.w } solutions on
Group } class web page

Departmental TA office hours in on-line syllabus

Problem: A roller coaster is traveling at 8.0 m/s when it comes to the top of a hill. It accelerates down the hill at 4.6 m/s^2 for 4.0 s. How far has it traveled in that time?

Given: $v_0 = 8\ m/s$
$a = 4.6\ m/s^2$
$t = 4\ s$

Want: d

$d = v_0 t + \frac{1}{2} a t^2$

$= (8\ m/s)(4\ s) + \frac{1}{2}(4.6\ m/s^2)(4\ s)^2$

$(32\ m) + \frac{1}{2}(2.3\ m/s^2)(16\ s^2)$

$32\ m + 36.8\ m = \boxed{68.8\ m}$

Problem: A train starts from rest and accelerates at a constant rate of 0.25 ft/s^2 over a distance of 1200 ft. How much time did this take?

Given: $v_0 = 0$ ft/s

$a = .25$ ft/s^2

$d = 1200$ ft

Want: t

$$d = v_0 t^{0} + \frac{1}{2} a t^2$$

$$d = \frac{1}{2} a t^2$$

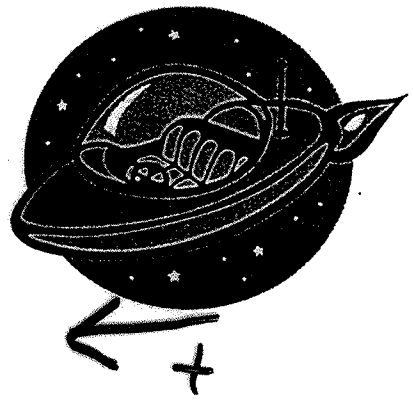
$$at^2 = 2d \qquad t^2 = \frac{2d}{a} \qquad t = \sqrt{\frac{2d}{a}}$$

$$t = \sqrt{\frac{2 \cdot 1200 \text{ ft}}{.25 \text{ ft/s}^2}} \qquad \frac{1}{1/s^2} \; s^2$$

$$t = 98 \text{ s}$$

This is a harder problem that requires two steps

Problem: A spacecraft is traveling with a speed of 3250 m/s, and it slows down by firing its retro rockets, so that it decelerates to a speed of 2050 m/s in 100 seconds. How far did it travel in that time?



Given: $V_0 = 3250$ m/s
$V = 2050$ m/s
$t = 100$ s

Want: d

1) $V = V_0 + at$
2) $d = V_0 t + \frac{1}{2} a t^2$

1) $at = V - V_0$

$a = \frac{V - V_0}{t} = \frac{2050 \text{ m/s} - 3250 \text{ m/s}}{100 \text{ s}}$

$a = -12 \text{ m/s}^2$

2) $d = (3250 \text{ m/s})(100 \text{ s}) + \frac{1}{2}(-12 \text{ m/s}^2)(100 \text{ s})^2$

$d = 325{,}000 \text{ m} + (-6 \text{ m/s}^2)(10{,}000$

$265{,}000 \text{ m}$

Interactive Question

Consider the equation $A = 1/B$. What happens to A if you double B?

A) A doubles
B) A stays the same
C) A decreases to 1/2 its initial value
D) A decreases to $1/\sqrt{2}$ its initial value
E) A decreases to 1/4 its initial value

Interactive Question

Consider the equation $A = C/B$. What happens to A if you triple B?

A) A triples
B) A stays the same
C) A decreases to 1/3 its initial value
D) A decreases to $1/\sqrt{3}$ its initial value
E) A decreases to 1/9 its initial value