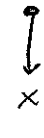
From textbook: 1.2: 2, 4, 10, 12, 16

2] Given: $v_0 = 8$ ft/s downward

Find: a) How far @ $t = 3$ s.
b) Velocity @ $t = 3$ s.

Assumptions: $g = 32\ \text{ft/s}^2$ positive downward



$x_0 = 0$

$x = \frac{gt^2}{2} + v_0 t + x_0 = 16t^2 + 8t$

Solution:

a) $x = 16(3)^2 + 8(3) = \boxed{168\ \text{ft}}$

b) $v = \frac{dx}{dt} = gt + v_0 = 32t + 8$

$v(3) = 32(3) + 8 = \boxed{104\ \text{ft/s}}$

4] Given: Two balls dropped from rest ($v_{0,1} = v_{0,2} = 0$).
$x_{0,1} = 16$ ft, $x_{0,2} = 32$ ft

Find: a) ratio of times to hit ground.
b) ratio if $x_{0,1} = h$ and $x_{0,2} = 2h$

Assumptions: $g = -32\ \text{ft/s}^2$ positive upward

$x = -\frac{g}{2}t^2 + x_0$

Solution:

a) $0 = -16t_1^2 + 16 \Rightarrow t_1 = 1$
$0 = -16t_2^2 + 32 \Rightarrow t_2 = \sqrt{2}$
$\Rightarrow \boxed{\frac{t_2}{t_1} = \sqrt{2}}$

b) $0 = -16t_1^2 + h \Rightarrow t_1 = \sqrt{h/16}$
$0 = -16t_2^2 + 2h \Rightarrow t_2 = \sqrt{h/8}$
$\Rightarrow \boxed{\frac{t_2}{t_1} = \sqrt{2}}$

10] Given: $x = 16t^2$, $x_0 = 32$ ft
start @ verbal command, stop @ sound of hit $\Rightarrow t'$
$t_{delay} = 0.25$ s

Find: a) How to correct for t_{delay}?
b) How to redesign so t_{delay} is irrelevant?

10 cont'l

Assumptions: none

Solution:

a) $t = t' - 2t_{delay}$

b) Trigger mechanism, not verbal to start/stop. Stopwatch @ start or stop. Sensors/technology (video).

12| Given: $T(x) = T_1 x^{\alpha}$

$T(10) = \frac{1}{2} T(1)$

Find: progress rate $= 2^{\alpha}$

Assumptions: none

Solution:

$T(10) = T_1(10)^{\alpha} = \frac{1}{2} T_1 \Rightarrow \alpha = -0.301$

$\Rightarrow$ progress rate = $\boxed{0.812}$

16| Given: $T(x) = T_1 x^{\alpha} + T_m$

Unit:	1	2	4	8
Hrs:	32000	25600	20480	16384

Find: T_m, α for good fit

Assumptions: none

solution: see Excel file ManufacturingProgressCurve.xlsx

$\Rightarrow \boxed{T_m = 0, \ \alpha = -0.322}$