$\boxed{2-7}$ $\bar{v} = D/t$

$D = 1\,\text{mile}$

$$\bar{v}_{RB} = \frac{1\,mi}{239.4\,s}$$

$$\bar{v}_{He-G} = \frac{1\,mi}{223.13\,s}$$

When He-G crosses finish line, RB has run a distance

$$x_{RB} = \bar{v}_{RB} \times t_{He-G}$$

$$= \frac{1\,mi}{239.4\,s} \times 223.13\,s$$

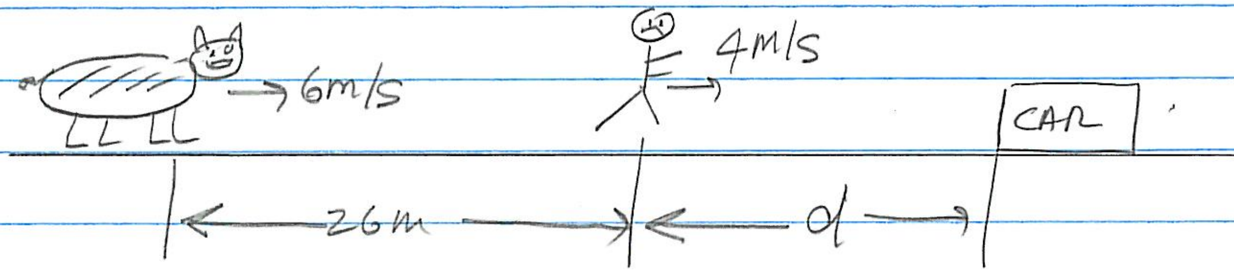
$$= 0.932\,mi$$

or he is behind by $1\,mi - 0.932\,mi$

$$= 0.068\,mi$$

[1 mile = 1609 m] ---> $\cong \underline{\underline{109\,m}}$

$\boxed{2-9}$



To just catch the tourist the bear must run a distance $d + 26\,m$ and the tourist must run at least a distance d

Tourist: $d = v_T \cdot t \quad \rightarrow \quad t = d/v_T$

Bear: $d + 26 = v_B t$

So $d + 26 = v_B \left(d/v_T \right)$

$v_T (d + 26) = v_B d$

$v_T d + v_T \cdot 26 = v_B d$

$v_T \cdot 26 = v_B d - v_T d = (v_B - v_T) d$

$4 \cdot 26 = (6 - 4) d = 2d$

$2d = 104$ or $\boxed{d = 52\,m}$

$\boxed{2-18}$

FIRST 1,2 S

(a) $v = v_0 + at$, $v_0 = 0$ (from rest)

$v(1.2s) = 2{,}3 \frac{m}{s^{\cancel{2}}} \times 1{,}2 \cancel{s}$

$= \underline{\underline{2{,}76}} \, m/s$

(b) Since $a = 0$ after 1,2 s, she maintains a speed of 2,76 m/s for the duration of the race.

$\boxed{2\text{-}24}$

6 m/s in 1.5 s

$$a = \frac{\Delta v}{\Delta t} = \frac{6\,m/s}{1.5\,s} = \underline{4\,m/s^2}$$

$$x = x_0 + v_0 t + \tfrac{1}{2} a t^2$$

$$= 0 + 0 + \tfrac{1}{2}(4)(1.5)^2$$

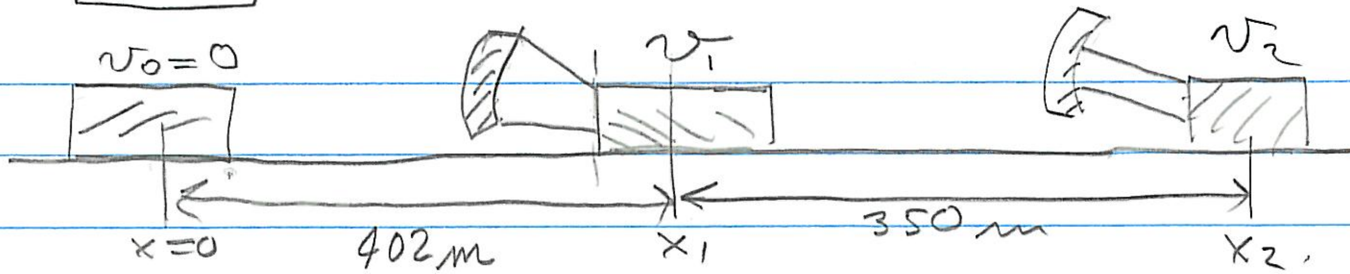
$$= \boxed{4.5\,m}$$

$\boxed{2\text{-}19}$

	Speed
(a) $v = v_0 + at$	
$= +12\,m/s + 3.0\,m/s^2 \cdot 2\,s$	
$= 12 + 6 = \underline{18\,m/s}$	18 m/s
(b) $v = +12\,m/s + (-3)(2)$	
$= 12 - 6 = \underline{6\,m/s}$	6 m/s
(c) $v = -12\,m/s + (+3)(2)$	
$= -12 + 6 = \underline{-6\,m/s}$	6 m/s
(d) $v = -12\,m/s + (-3)(2)$	
$= -12 - 6 = \underline{-18\,m/s}$	18 m/s

<u>Speed</u> is the <u>magnitude</u> of velocity

2-37



speed at 402 m, $a = 17\,m/s^2$

$$v_1^2 = v_0^2 + 2ax$$

$$v_1^2 = 2ax = 2 \times 17 \times 402$$

$$v_1 = 117\ m/s$$

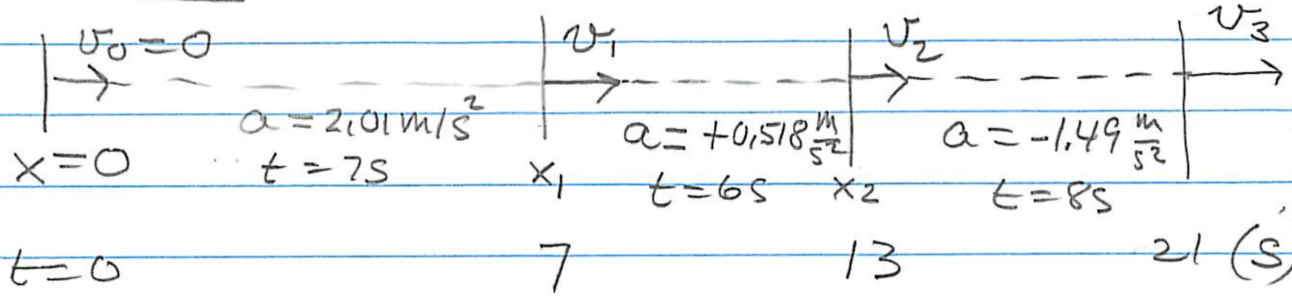
Next 305 m with $a = -6.1\,m/s^2$

$$v_2^2 = v_1^2 + 2a(x_2 - x_1)$$

$$v_2^2 = (117)^2 + 2(-6.1)(350m)$$

$$\boxed{v_2 = 97\ m/s}$$

2-38



(a) $v_1 = v_0 + at = 0 + 2.01(7) = 14.07\,m/s$

$v_2 = v_1 + at = 14.07 + 0.518(6) = 17.18\,m/s$

$v_3 = v_2 + at = 17.18 + (-1.49)8 = \underline{5.26\,m/s}$

(b) $x_1 = x_0 + \frac{1}{2}at^2$

$= 0 + \frac{1}{2}(2.01)(7)^2 = \underline{49.3\,m}$

in the next 6s, the boat travels

$x_2 - x_1 = v_1 t + \frac{1}{2}at^2$

$= 14.1(6) + \frac{1}{2}(0.518)(6)^2$

$= \underline{93.9\,m}$

in the next 8 s, the boat travels

$x_3 - x_2 = v_2 t + \frac{1}{2}at^2$

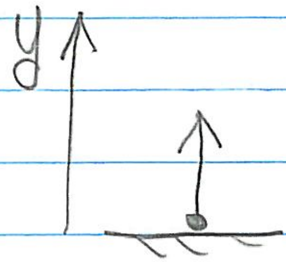
$= (17.2)(8) + \frac{1}{2}(-1.49)(8)^2$

$= \underline{89.9\,m}$

TOTAL displacement $= 49.3 + 93.9 + 89.9 \simeq \underline{233\,m}$

$\boxed{2-44}$

Take $+y$ up starting at ground



(a) $v = v_0 + a_y t$

$= v_0 - gt$

$15\,m/s = v_0 - 9.8(2)$

$v_0 = 15 + 9.8(2) = \underline{34.6\,m/s}$

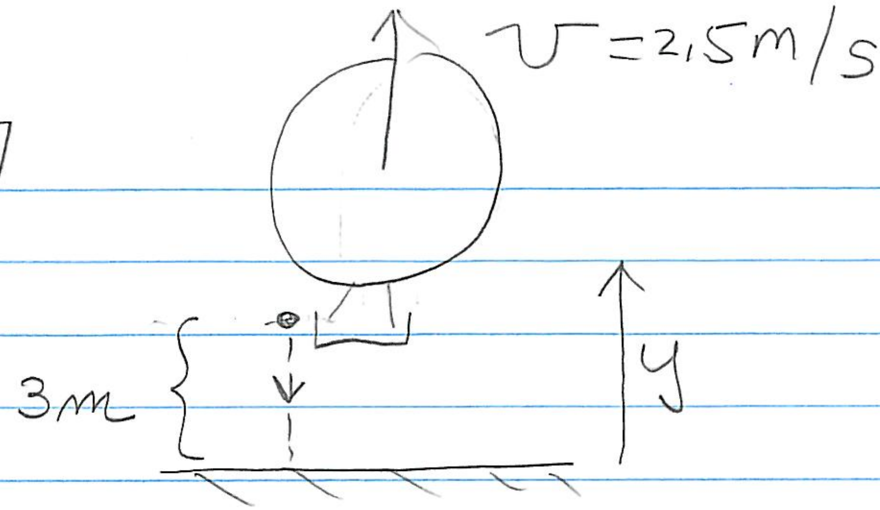
(b) $v = v_0 - gt$

$v = 34.6 - 9.8\,(5)$

$= -14.4\,m/s$

speed is $\underline{14.4\,m/s}$, it is on its way down.

2-50



When the compass is dropped, it is moving upward at 2.5m/s.

$$y = y_0 + v_{0y}t - \frac{1}{2}gt^2$$

$$0 = 3m + 2.5t - \frac{1}{2}9.8t^2$$

$$0 = 3 + 2.5t - 4.9t^2$$

$$4.9t^2 - 2.5t - 3 = 0$$

This is a quadratic equation, so we must use the quadratic formula to solve for t

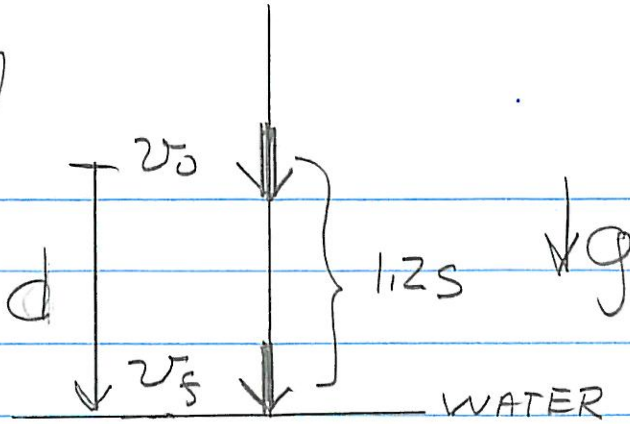
$$t = \frac{-(-2.5) \pm \sqrt{(-2.5)^2 - 4(4.9)(-3)}}{2(4.9)}$$

$$= \frac{2.5 \pm \sqrt{65}}{9.8} = \frac{2.5 \pm 8.1}{9.8}$$

t must be ⊕, so choose ⊕

$\therefore$ $t \cong 1.08s$

2-55



$v_f = -10.1\,m/s$ is the velocity of the diver as she enters the water, v_0 is her velocity 1.2s earlier and d is her displacement during the last 1.2s before she enters the water

use displacement $d = \bar{v}t = \frac{1}{2}(v_0 + v_f)t$

v_f and t are known, but v_0 is not known, but her acceleration which is g during this period can be written as

$$g = \frac{v_f - v_0}{t} \Rightarrow v_f - v_0 = gt$$

Take all quantities as + downward

$$2d = (v_0 + v_f)t \;;\quad v_0 = v_f - gt$$

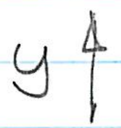
combine

$$2d = (v_f - gt + v_f)t = 2v_f t - gt^2$$

$$d = v_f t - \frac{1}{2}gt^2 = 10.1(1.2) - \frac{1}{2}9.8(1.2)^2$$

$$d = 5.06\,m$$

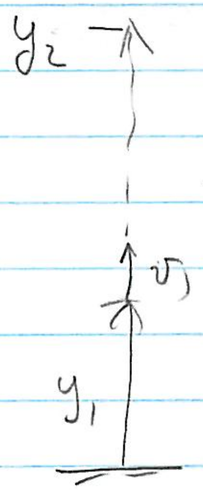
$\boxed{2\text{-}62}$



$\uparrow \; a = 86.0\,m/s^2$

$$y_1 = \tfrac{1}{2} a_1 t_1^2 = \tfrac{1}{2}(86)(1.7s)^2 = 124\,m$$

$$v_1 = a_1 t_1 = 86 \cdot 1.7 = 146\,m/s$$



$$v_{Top}^2 = v_1^2 + 2g(y_2 - y_1)$$

$$0 = (146)^2 + 2(-9.8)(y_2 - 124)$$

$$\frac{(146)^2}{2 \cdot 9.8} = y_2 - 124$$

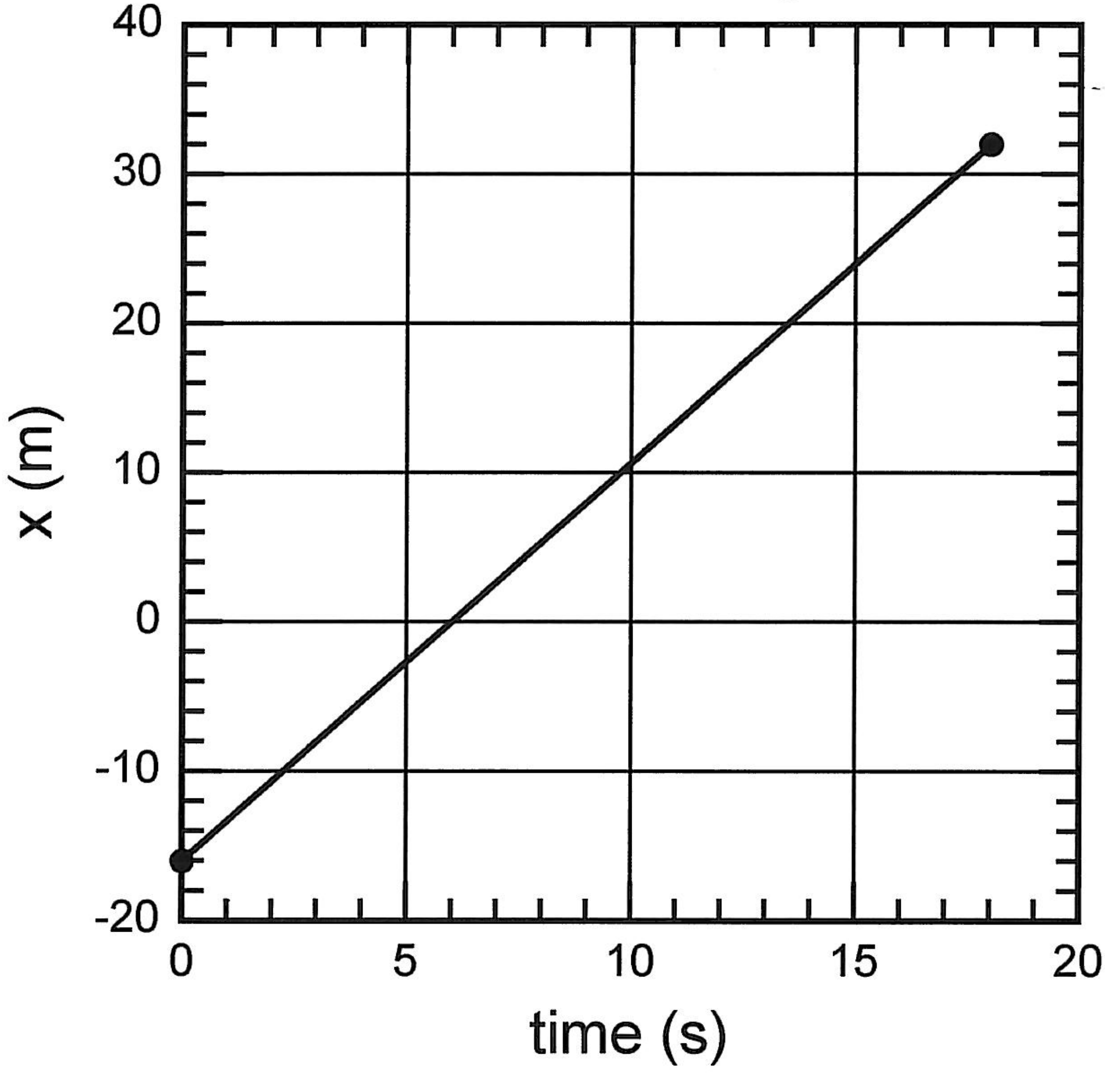
$$1088 = y_2 - 124$$

$$y_2 = 1212\,m$$

$\boxed{2-66}$

$$v = \frac{x_f - x_i}{\Delta t}$$

$$= \frac{32-(-16)}{18} = \frac{32+16}{18}\ m/s$$



$$v = \frac{48}{18} = \underline{+2.67\ m/s}$$

$\boxed{2\text{-}77}$

$\bar{v} = d/t \Rightarrow t = d/\bar{v}$

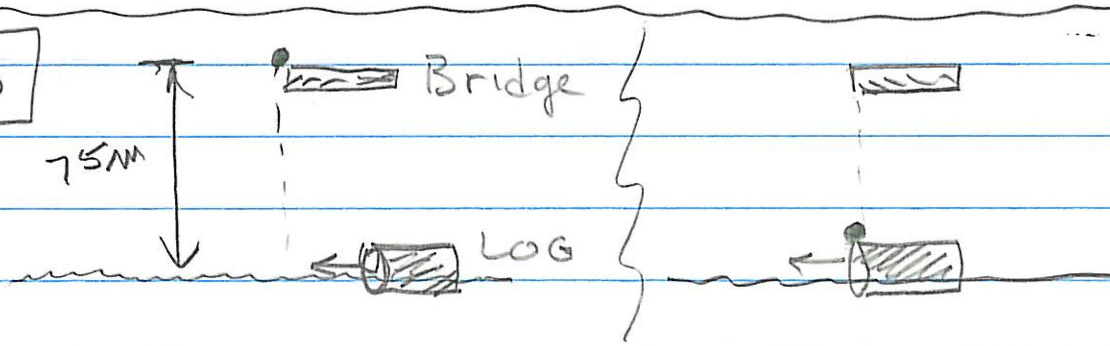
$= 1.8\text{m}/110\text{m/s}$

$= 0.016\text{ s}$

$= 1.6 \times 10^{-2}\text{s}$

or 16 milliseconds (ms)

$\boxed{2\text{-}83}$



$v_{Log} = 5.0\text{m/s}$

Time for stone to fall 75 m from rest

$y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$

$0 = 75 + 0 - \frac{1}{2}(9.8)t^2 \Rightarrow t = 3.9\text{s}$

in 3.9 s, log moves $x_{Log} = v_{Log}t$

$= \underline{19.6\text{ m}}$

$\therefore$ Log was 19.6 m from edge of bridge when stone left bridge.