Graphical Analysis of Motion I

① a) **Alexa** walked the fastest. (greatest slope on d vs t graph)

b) **slope**

② a) $V_{avg} = \frac{d_2 - d_1}{t_2 - t_1} = \frac{100m - 0m}{4s - 0s} = +25 \, m/s$

b) $V_{avg} = 0 \, m/s$ ← slope = 0 btwn 4s & 6s

c) $V_{avg} = \frac{d_2 - d_1}{t_2 - t_1} = \frac{0m - 100m}{8s - 6s} = \frac{-100m}{2s} = -50 \, m/s$

d) neg. slope ⇒ neg. ave. vel. ⇒ object **moving left**, ⇓ toward the stop sign

e) pos. slope ⇒ pos. ave. vel ⇓ object moving in the positive direction which is **rightward**

f) vel. is zero when **slope is 0** for d vs t graph

g) $V_{ave} = \frac{d_2 - d_1}{t_2 - t_1} = \frac{100m - 0}{6s - 0s} = +16.7 \, \frac{m}{s}$

(3) **Blue** slope of v vs t graph is acc.

(4) a) **3s to 5s** is the largest acceleration because acc. = slope of v vs t graph

b) stationary ⇒ v=0 ⇒ **0-3s** & 20s

↑ not really an interval... ok to leave out

c) The person was climbing **up the rope, but slowing down**

d) **3s - 20s**

(5) Area under of v vs t graph is displacement

⇒ Area = **displacement btwn t=0 & t=7s**

(6) Area under a vs t graph is change in velocity

⇒ Area = **change in vel. btwn t=4s & t=7s**

(7)

a) $\Delta d =$ area under v vs t graph $= (10\,min)(250\,ft/min) = {}^{+}2500\,ft$

$\Rightarrow$ **2500 ft east of intersection**

b) $\Delta d_{10min \to 15min} = \frac{1}{2} b \cdot h = \frac{1}{2}(5)(250) = {}^{+}625\,ft$

$2500\,ft + {+625\,ft} = +3125\,ft$

3125 ft east of intersection

c) $a = \frac{\Delta V}{\Delta t} = \frac{0}{10\,min} = \boxed{0}$

d) $a = \frac{V_2 - V_1}{t_2 - t_1} = \frac{0 - 250\,ft/min}{15\,min - 10\,min} = \frac{-250\,ft/min}{5\,min}$

$= \boxed{-50\,\frac{ft}{min^2}}$

(8)

a) $\Delta V =$ area under a vs t graph $= 2s\,(15\,m/s^2) = {}^{+}30\,m/s$

$0\,\frac{m}{s} + {}^{+}30\,\frac{m}{s} = \boxed{+30\,m/s}$

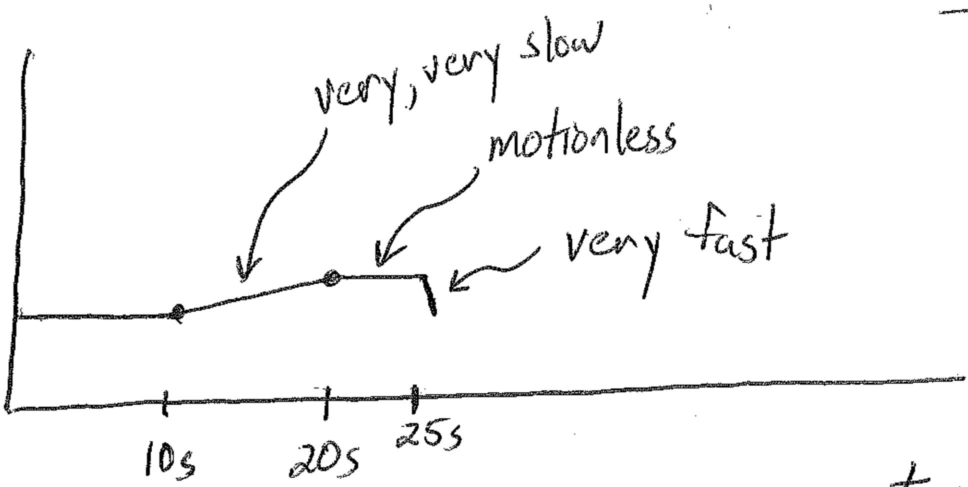
b) $\Delta V_{2s \to 3s} =$ area under a vs t graph $= \underbrace{\frac{1}{2}(1s)(25\,\frac{m}{s^2})}_{\text{triangle}} + \underbrace{1s\,(15\,m/s^2)}_{\text{rectangle under triangle}}$

$\Delta V_{2s \to 3s} = 12.5\,\frac{m}{s} + 15\,\frac{m}{s} = 27.5\,\frac{m}{s}$

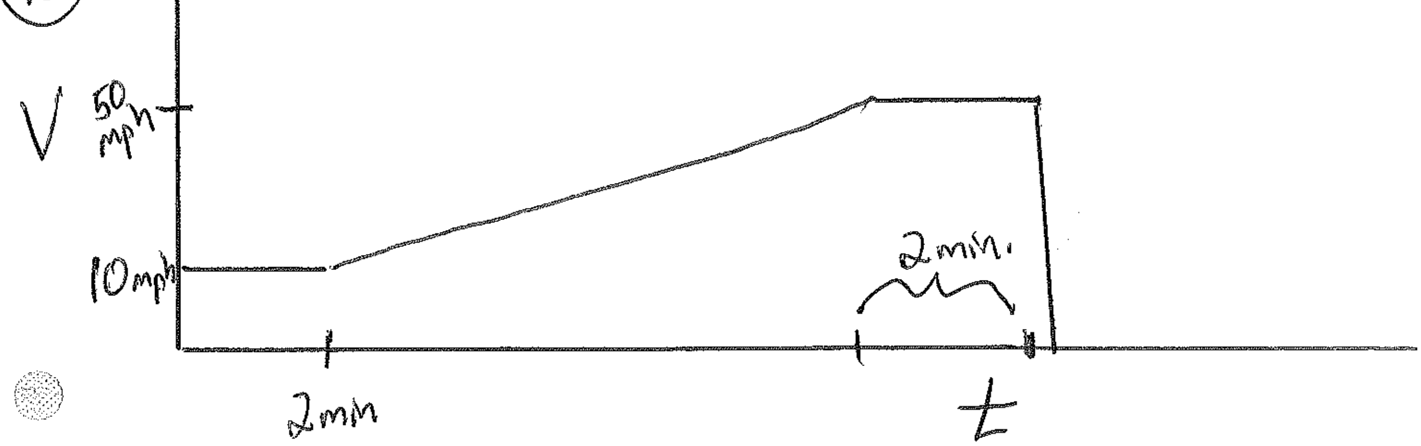
$\Uparrow$

$30\,\frac{m}{s} + 27.5\,\frac{m}{s} = \boxed{57.5\,\frac{m}{s}}$

(9)



(10)



(11) (A) $\Delta V =$ area under a vs. t graph $= 4s(2\,m/s^2) = +8\,m/s$

(B) $+0\,(5)\,m/s + {}^{+}8\,m/s =$ [illegible] $= V_{4s} = 13\,m/s$

(C) $\Delta V_{4s \to 8s} =$ area under a vs t graph $= \frac{1}{2}(4s)(2\,m/s^2) = {}^{+}4\,m/s$

$+8\,m/s + (+4\,\frac{m}{s}) =$ [illegible] $= V_{8s} = +17\,\frac{m}{s}$

(D) $\Delta V_{8s \to 12s} =$ area under a vs t graph $= -\frac{1}{2}(4s)(3\,\frac{m}{s^2}) = -6\,m/s$

$V_{12s} = +12\,\frac{m}{s} + (-6\,\frac{m}{s}) =$ [illegible] $= +11\,m/s$

(12) a) (6s - 12s) & 15s - 21s

b) going up ⇒ vel. "+" ⇒ (0 - 3s) & (14s - 21s)

c) going down ⇒ vel. "−" ⇒ 3s - 14s

d) 3s & 14s

e) No. It was going down @ −25 m/s

f) $a = \frac{V_2 - V_1}{t_2 - t_1} = \frac{-25\,\frac{m}{s} - (+25)}{6s - 0s} = \frac{-50\,m/s}{6s} = -8.3\,m/s^2$