Kinematics II

(1) a) $10\frac{m}{s^2} \cdot 9s = \boxed{90 m/s}$

b) $\cdot$ 0 m/s ↓ 90 m/s } ave. speed $= 45\frac{m}{s}$

$45\frac{m}{s} \cdot 9s = \boxed{405m}$

c) $\cdot$ 0 m/s ↓ $45\frac{m}{s}$ } $22.5\frac{m}{s}$ = ave. speed

$22.5\frac{m}{s}(4.5s) = \boxed{101.25 m}$

(2) $\cdot$ 0 m/s, ↑ 160 m/s; $80\frac{m}{s}$ = ave. speed

a) $\boxed{16s}$

b) $80\frac{m}{s} \cdot 16s = \boxed{1280m}$

c) 16s + 16s = $\boxed{32s}$
up down

d) $\boxed{160 m/s}$

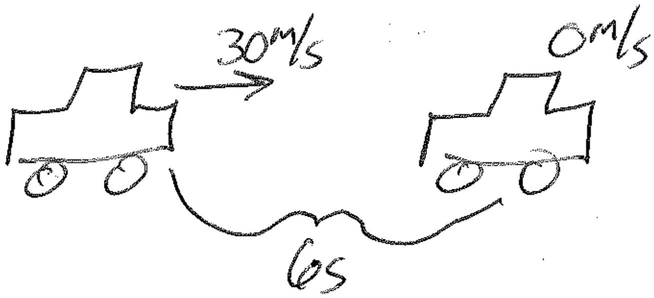
e) ↑ 130 m/s, ↑ 160 m/s } $145\frac{m}{s}$ = ave. speed

$145\frac{m}{s} \cdot 3s$ = $\boxed{435m}$

f) ↑ $60\frac{m}{s}$, ↑ $160\frac{m}{s}$ } $110\frac{m}{s} = V_{ave}$

$110\frac{m}{s} \cdot 10s = \boxed{1100m}$

(3)

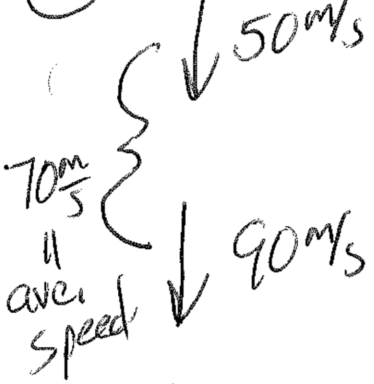


a) $a = \frac{v_2 - v_1}{t_2 - t_1} = \frac{0\frac{m}{s} - 30\frac{m}{s}}{6s - 0s} = \frac{-30\frac{m}{s}}{6s} = \boxed{-5\frac{m}{s^2}}$

b) $\text{ave. speed} = \frac{30\frac{m}{s} + 0\frac{m}{s}}{2} = 15\frac{m}{s}$

$15\frac{m}{s} \cdot 6s = \boxed{90m}$

(4)



a) $\boxed{90\frac{m}{s}}$

b) $70\frac{m}{s} \cdot 4s = \boxed{280m}$

(5) a) $\text{ave. speed} = \frac{d}{t} = \frac{1500m}{213s} = \boxed{7.04\,m/s}$

b) $\text{ave. speed} = \frac{d}{t} = \frac{100m}{9.9s} = \boxed{10.1\,m/s}$

(6) $a = \frac{\Delta v}{\Delta t} = \frac{50mph}{4.5s} = \boxed{11.1\,mph/s}$

(7) $a = \frac{\Delta v}{\Delta t} \Rightarrow 8.2\,m/s^2 = \frac{23\,m/s}{\Delta t} \Rightarrow \Delta t = \frac{23\frac{m}{s}}{8.2\,m/s^2} = \boxed{2.8s}$

(8)

a) $\boxed{-36 \text{ mph}}$

b) $\boxed{-32 \text{ mph}}$ @ 1s

$\boxed{-28 \text{ mph}}$ @ 2s

$\boxed{0 \text{ mph}}$ @ 9s

(9)

a) $\boxed{+20 \text{ m/s}}$

b) $\Delta V_{0 \to 3s}$ = area under a vs t graph $= 5\frac{m}{s^2}(3s) = +15\frac{m}{s}$

$V_{3s} = +20\frac{m}{s}$ (initial vel.) $+ (+15\frac{m}{s})$ (gain in vel.) $= \boxed{+35\frac{m}{s}} = V_{3s}$

c) $\Delta V_{3s \to 7s}$ = area under a vs t graph $= \frac{1}{2} b \cdot h = \frac{1}{2}(4s)(5\frac{m}{s^2})$

$= +10 \text{ m/s}$

$V_{7s} = +35\frac{m}{s}$ (vel @ 3s) $+ 10\frac{m}{s}$ (gain in vel.) $= \boxed{+45\frac{m}{s}} = V_{7s}$

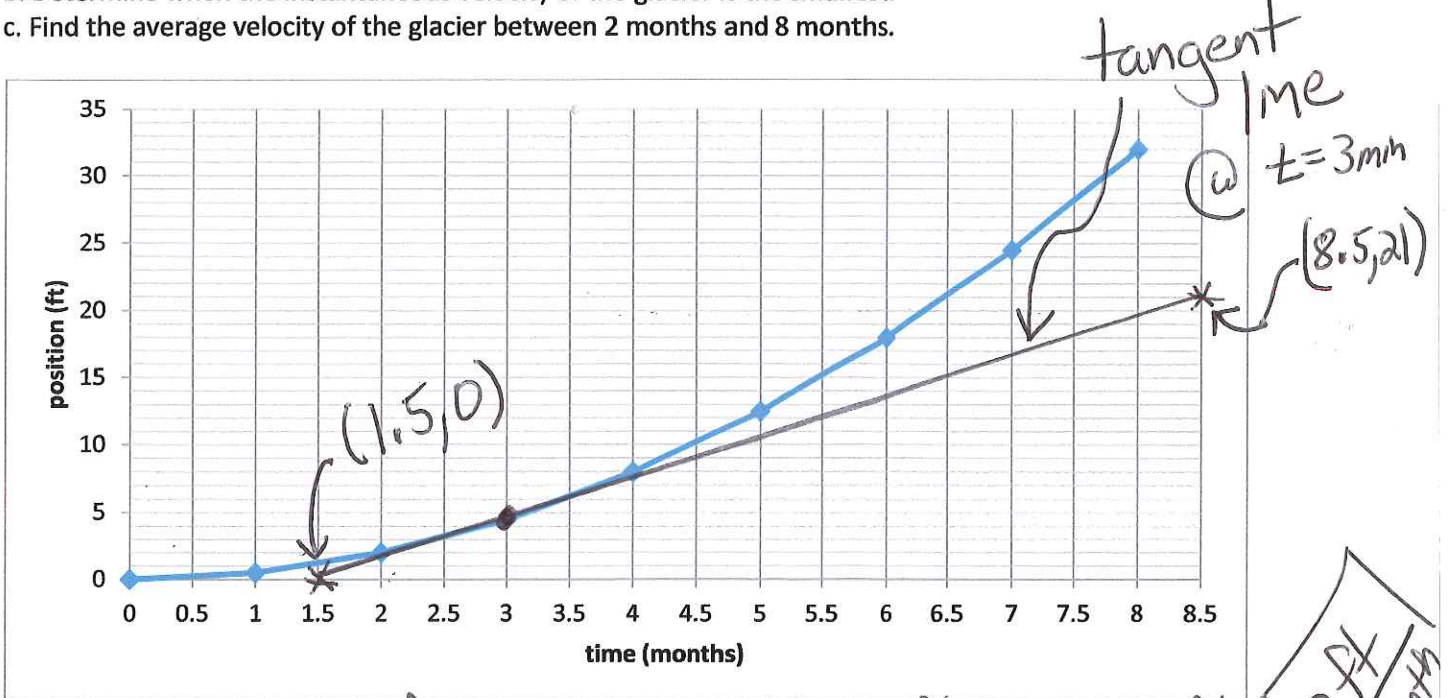
d) $\Delta V_{7s \to 9s}$ = − [area under a vs t graph] $= -\frac{1}{2} bh = -\frac{1}{2}(2s)(4\frac{m}{s^2})$

$= -4 \text{ m/s}$

$V_{9s} = +45\frac{m}{s} + (-4\frac{m}{s}) = \boxed{+41 \text{ m/s}}$

(10)

10. Geologists collected the position vs. time data for the leading edge of an advancing glacier.
   a. Find the instantaneous velocity of the glacier at 3 months.
   b. Determine when the instantaneous velocity of the glacier is the smallest.
   c. Find the average velocity of the glacier between 2 months and 8 months.



a) inst. vel = slope of tan line $= \frac{\text{rise}}{\text{run}} = \frac{21\text{ ft} - 0\text{ ft}}{8.5\text{ months} - 1.5\text{ months}} = \frac{21\text{ ft}}{7.0\text{ months}} = +3\frac{\text{ft}}{\text{month}}$

acceptable range $2.25\frac{\text{ft}}{\text{month}} - 3.75\frac{\text{ft}}{\text{month}}$

b) Inst. vel is smallest when the slope of the tan line is smallest. This happens @ $t = 0$ when tan line looks to have a slope of 0.

c) $V_{avg} = \frac{d_2 - d_1}{t_2 - t_1} = \frac{32\text{ ft} - 2\text{ ft}}{8\text{ months} - 2\text{ months}} = \frac{+30\text{ ft}}{6\text{ months}} = +5\frac{\text{ft}}{\text{month}}$