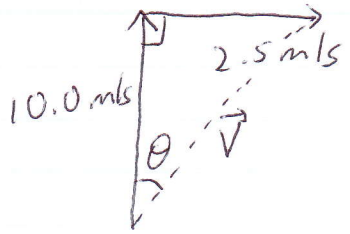
Test Review Solutions

The graph multiple choice question is very badly worded. It is essentially asking for the segment that has a negative average velocity, which is DE because it has a negative slope.

1. 

$\vec{V}^2 = (10.0\ m/s)^2 + (2.5\ m/s)^2$

$\vec{V} = \sqrt{100\ m^2/s^2 + 6.25\ m^2/s^2}$

$\vec{V} = 10.3\ m/s$

$\text{Tan}\,\theta = \left(\frac{2.5}{10.0}\right) \Rightarrow \theta = 14.0^\circ$

$\vec{V} = 10.3\ m/s\ [N14^\circ E]$

2. Speed of light is constant. So $V_i = V_f = 3.00 \times 10^8\ m/s$.

Earth: $3.00 \times 10^8\ m/s \times \left[8.00\ min \times \frac{60\ s}{1\ min}\right]$
$= 1.44$ ell m or 1.44×10^{11} m

Mars: $3.00 \times 10^8\ m/s \times \left[15.00\ min \times \frac{60\ s}{1\ min}\right]$
$= 2.70 \times 10^{11}$ m or 2.70 ell m.

3. $V_i = 0\ m/s$, $a = 70000.\ m/s^2$, $V_f = 500.0\ m/s$
$d = ?$ $t = ?$

$V_f^2 = V_i^2 + 2ad$

$(500.0\ m/s)^2 = (0\ m/s)^2 + 2(70000.\ m/s^2)(d)$

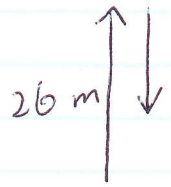
$250,000\ m^2/s^2 = 140000\ m/s^2\,(d)$

$d = 1.786\ m$

$V_f = V_i + at$

$500.0\ m/s = 0\ m/s + 70000\ m/s^2\,(t)$

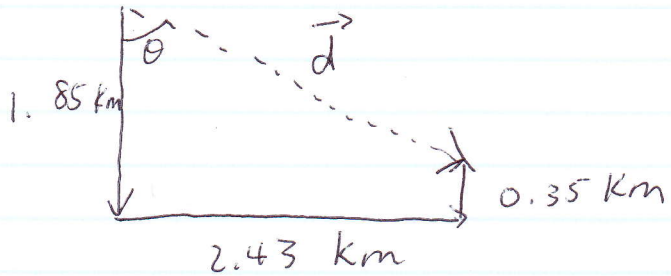
$t = 7.143 \times 10^{-3}\ s$.

4. 

total displacement = 26m - 12m = 14m
= 14.0m

total time = 2.00 min + 4.00 min + 1.15 min
= 7.15 min

$\vec{V} = \frac{14.0\ m}{7.15\ min} = 1.96\ m/min$ (north is positive)

5. 

x: $-1.85\ km + 0.35\ km = -1.50\ km$
y: $2.43\ km$

$\vec{d}^2 = (2.43\ km)^2 + (1.50\ km)^2$
$d = 2.86\ km$

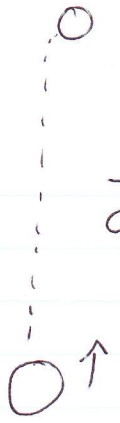
$\tan\theta = \frac{2.43}{1.50}$
$\theta = 58.3^\circ$

$\vec{d} = 2.86\ km\ [S\ 58.3^\circ\ E]$

6. 
$V_i = 0\ m/s$ $\quad d = -125\ m$
$\vec{a} = -9.81\ m/s$ $\quad t = ?$

$d = V_i t + \frac{1}{2} a t^2$
$-125\ m = (0\ m/s)t + \frac{1}{2}(-9.81\ m/s^2)\ t^2$
$-125\ m = -4.905\ m/s^2\ (t^2)$
$t = 5.05\ s$

7.



$V_f^2 = V_i^2 + 2ad$

$(0.0\ m/s)^2 = (V_i)^2 + 2(-9.81\ m/s^2)(5.58\ m)$

$0 = V_i^2 - 109.4796\ m^2/s^2$

$V_i^2 = 109.4796\ m^2/s^2$

$V_i = 10.5\ m/s$

Projectile Question:

$V_x = 50.0$ km/h $\quad \vec{a}_x = 0.0\ m/s^2$

$d_y = -100.\ m \quad \vec{a}_y = -9.81\ m/s^2$

$d_x = ?$

A car drives off a cliff at a velocity of 50.0 km/h. If the cliff is 100. m high, how far away will the car hit the water? (relative to the bottom of the cliff)

t is the most important variable in a projectile question. Try to find it first.

Find t using $d_y = V_{iy} \cdot t + \frac{1}{2}\vec{a}_y t^2$

Remember that the kinematics equations only work in one dimension. Do not mix x and y values.

$-100.\ m = (0\ m/s)t + \frac{1}{2}(-9.81\ m/s^2)t^2$

$-100.\ m = -4.905\ m/s^2 \cdot t^2$

$t = 4.52\ s$

Now that we have the time, use it to solve the problem.

V_x is constant, so $d_x = V_x \cdot t$

converting to m/s

$$d_x = (50.0 \text{ km/h})\left(\frac{1000 \text{ m}}{1 \text{ h}}\right)\left(\frac{1 \text{ h}}{3600 \text{ s}}\right)(4.52 \text{ s})$$

$$d_x = 62.8 \text{ m}$$

The car will land 62.8 m away from the base of the cliff.