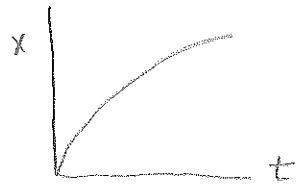
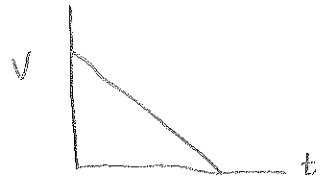
One Dimensional Conceptual and Problems: Horizontal and Vertical Motion Answers

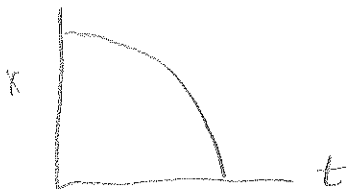
1. The object's velocity is in the positive direction. Since the object is in free fall it has an acceleration in the negative direction. The directions of velocity and acceleration are opposite; therefore, the object slows down. (decreasing positive velocity)
2. As the object falls back to its original position the velocity and acceleration are both in the negative direction. Since they are in the same direction the object speeds up. (increasing negative velocity)
3. .

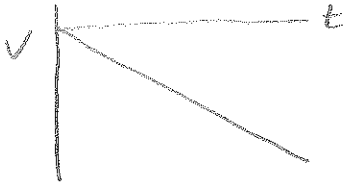




* Both show a decreasing positive velocity as it rises.

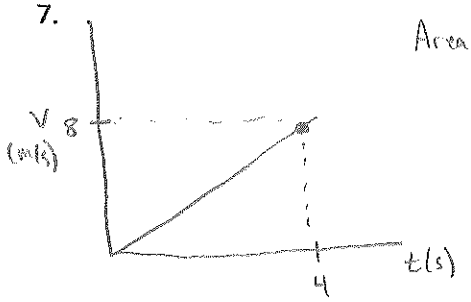
4. .





* Both show an increasing (-) velocity as it falls.

5. The object is in free fall on the way up and the way back down, so in both situations the object has an acceleration (experiences a change in velocity).
6. Since the book is moving to the right its motion is positive. The velocity always matches the direction of the motion, so we have a positive velocity. The object is slowing down so the acceleration must be in the negative direction.
7.



Area = displacement = $v \cdot t$

$\frac{1}{2}bh = \frac{1}{2}(4s)(8\,m/s) = 16m$

* Answers should be the same.

$V_0 = 0 \quad V_f = 8\,m/s \quad a = 2.0\,m/s^2$

$t = 4.0\,s$

$\Delta x = v_0 t + \frac{1}{2}at^2$

$\Delta x = \frac{1}{2}(2)(4)^2$

$\Delta x = 16m$

8. .

$a_y = -9.8\,m/s^2$

$\Delta y = -2.5\,m$

$V_{oy} = 0\,m/s$

$t = ?$

$V_{yf} = ?$

$\Delta y = v_{oy}t + \frac{1}{2}a_y t^2$

$\Delta y = \frac{1}{2}at^2$

$-2.5m = \frac{1}{2}(-9.8\,m/s^2)(t)^2$

$.51 = t^2$

$t = 0.71s$

$V_{yf}^2 = V_{y0}^2 + 2a\Delta y$

$V_{yf}^2 = 0 + 2(-9.8)(-2.5)$

$V_{yf}^2 = 49$

$V_{yf} = -7\,m/s$

* (-) b/c it's moving down ↓

Δx_1 requires acceleration, so find that first.

9. $V_0 = 0\ m/s$, $V_f = 12\ m/s$, $t = 6.0\ s$ } part 1, $\Delta x_1 = ?$

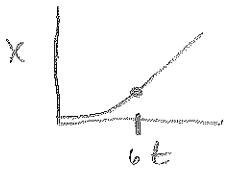
$V_f = V_0 + at$

$12 = a(6)$

$a = 2.0\ m/s^2$

$\Delta x_1 = V_0 t + \frac{1}{2}at^2$ ($V_0 = 0$)

$\Delta x_1 = \frac{1}{2}(2)(6)^2 = 36m$

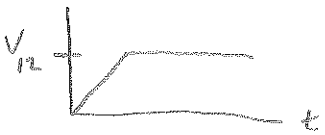


$V = 12\ m/s$ (constant) } part 2, $t = 10\ s$, $\Delta x_2 = ?$, $a = 0\ m/s^2$

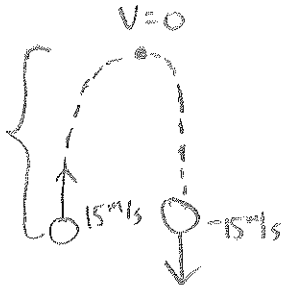
$\Delta x_2 = V_0 t + \frac{1}{2}at^2$ ($a = 0$)

$\Delta x_2 = (12)(10) = 120m$

$\Delta x_{TOT} = 36m + 120m = 156m$



10. $V_0 = 15\ m/s$, $a_y = -9.8\ m/s^2$, $\Delta y_{max} = ?$, $V = 0$ @ Δy_{max}, $V_f = -15\ m/s$ if returns to same level. $\Delta t = ?$



$V_{yf}^2 = V_{y0}^2 + 2a\Delta y_{max}$ ($V_{yf} = 0$)

$0 = 15^2 + 2(-9.8)\Delta y_{max}$

$-225 = -19.6\,\Delta y_{max}$

$\Delta y_{max} = 11.5m$

$V_f = V_0 + at$

$-15 = 15 + -9.8(t)$

$-30 = -9.8t$

$t = 3.1\ s$

11. The ball's velocity when it hits the ground will be greater than the initial launch velocity. The ball will accelerate in the negative direction for a longer period of time giving it a larger velocity as it falls below its launch point.
12. No, the object could be moving in the negative direction (negative velocity) which means the object is speeding up. An example of this would be a falling object. The velocity and acceleration are both in the negative direction so it will speed up.