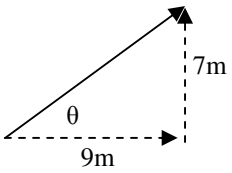
Due Mon., Sept 12

2011 PreAP Linear Motion 12

OK—Time for a learning homework. Answers will be given at the end of each problem in parenthesis. Solutions are on the back page. If you just want to copy, that's your choice, but you won't learn anything. You may need scratch paper.



1. Find the length of the hypotenuse and the angle. (H = 11.4 m; θ = 37.9°)

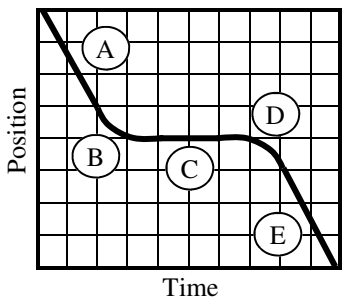
2. Always the optimist, Jar Jar Binks survives his fall off the cliff and believes the devote Star Wars fans were just joking. So, in a gesture of friendship, Jar Jar lobs an orange 12 m/s into the air from the ground to what he thinks are his adoring fans. The orange is, of course, rejected by the Star Wars-ians and lands back on the ground. Calculate the time the orange was in the air. (2.45 sec)

3. The Star Wars devotees instead start throwing tomatoes down at Jar Jar. The initial velocity of the tomatoes is 5 m/s downward and thrown from 26 m up on top of the cliff. What is the speed of the tomatoes as they pummel Jar Jar, helping him to realize that they are NOT fans? ($v_f = -23.1$ m/s, S = 23.1 m/s)

4. Thinking that they might FINALLY be able to rid the Star Wars Universe of this Gungan reject, the crowd of Star Wars-ians runs down the mountain toward Jar Jar at a frenzied yet constant speed of 2.5 m/s.
   A. How far did they run in that joyous 2 minutes? (300 m)
   B. What is their final velocity after the 2 minute run? (2.5 m/s)

5. It took a while for Mr. Genius to realize that the Star Wars Devotees were out to get him. Having already retrieved his orange from the ground, Jar Jar looks up to see the angry crowd coming around the corner of the hill. He drops the orange from 1.5 m up. How long does it take for the orange to hit his foot? (0.55 sec)

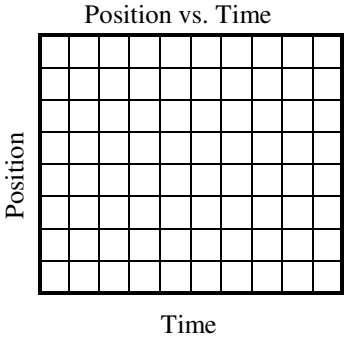
6. Now finally aware that his character (and actual life) is in peril, Jar Jar jumps into his land speeder (yes, one of the goofy ones from the first movie [the one Lucas calls Star Wars IV, now]). He drives 45 m/s for 20 seconds, then looks back to see them following in another speeder and drives 80 m/s for 40 seconds. Calculate the total distance he travelled and his average velocity for the whole trip. (*And just like Lucas' adjustments with new DVD releases, this story will continue…*) *(68.3 m/s)*

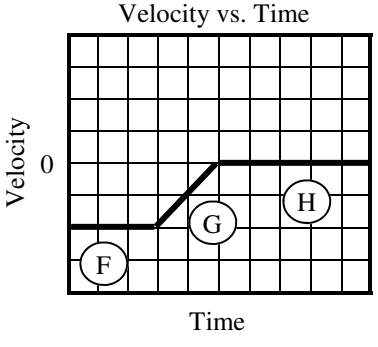


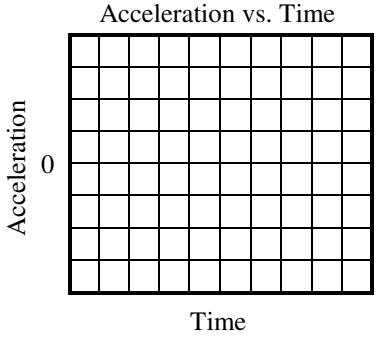
7. Assuming each square is 1 m by 1 second, calculate the average velocity for the first 6 seconds of the position vs time graph at the left. (−0.67 m/s)

8. Use line segments A—H to answer the following. Is it +, −, or 0?

   A. ___ Δx for segment E.
   B. ___ v for segment H.
   C. ___ a for segment B.
   D. ___ Δv for segment G.
   E. ___ Δx for segment D.
   F. ____Δv for segment A.
   G. ____v for segment F.
   H. ____ a for segment C.
   I. ____ Δv for segment B.
   J. ____Δx for segment D.







9. Transfer the velocity vs. time graph to the other two graphs. Assume each square is 1 m by 1 second.

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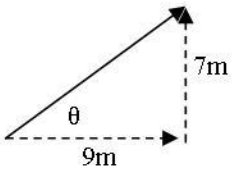


1. Find the length of the hypotenuse and the angle. (H = ; θ = °)

$H^2 = 7^2 + 9^2$ $\quad \tan\theta = \frac{O}{A} = \frac{7}{9}$

$H = 11.4m$ $\quad \theta = \tan^{-1}(7/9) = 37.9°$

2. Always the optimist, Jar Jar Binks survives his fall off the cliff and believes the devote Star Wars fans were just joking. So, in a gesture of friendship, Jar Jar lobs an orange 12 m/s into the air from the ground to what he thinks are his adoring fans. The orange is, of course, rejected by the Star Wars-ians and lands back on the ground. Calculate the time the orange was in the air.

$v_i = +12 m/s$ $\quad t = 0$ $\quad a = -9.8 m/s^2$ $\quad \Delta y = 0 m$ $\quad v_f = -12 m/s$ (and)

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

$0 = 12t + \frac{1}{2}(-9.8)t^2$

$-12t = -4.9t^2$ (cancel a t)

$-12 = -4.9t$

$t = 12/4.9$

$t = 2.45 sec$

OR $v_f = v_i + at$

$-12 = 12 - 9.8t$

$-24 = -9.8t$

$t = 24/9.8 = 2.45 sec$

3. The Star Wars devotees instead start throwing tomatoes down at Jar Jar. The initial velocity of the tomatoes is 5 m/s downward and thrown from 26 m up on top of the cliff. How fast do the tomatoes hit Jar Jar, helping him to realize that they are NOT fans?

(could call down +) so $v_i = 5 m/s$ $\quad a = 9.8 m/s^2$ $\quad \Delta y = 26 m$ $\quad v_f = ?$

$v_f^2 = v_i^2 + 2a\Delta y$

$v_f^2 = 5^2 + (2(9.8)(26))$

$v_f^2 = 25 + 509.6$

$v_f^2 = 534.6$

$v_f = 23.1 m/s$ (down)

if you called vi neg, then a, y, and vf are neg, too.

4. Thinking that they might FINALLY be able to rid the Star Wars Universe of this Gungan reject, the crowd of Star War-ians run down the mountain toward Jar Jar at a frenzied and constant speed of 2.5 m/s.
   A. How far did they run in 2 minutes? $= 120 sec$ $\quad S = D/T$ $\quad D = ST = 2.5(120) = 300 m$
   B. What is their final velocity after the 2 minute run?

still 2.5 m/s (constant speed)

5. It took a while for Mr. Genius to realize the Star Wars Devotees were coming to get him. Having already retrieved his orange from the ground, Jar Jar looks up to see the angry crowd coming around the corner of the hill. He drops the orange from 1.5 m up. How long does it take for the orange to hit his foot?

$\Delta y = -1.5 m$ $\quad a = -9.8 m/s^2$ $\quad t = ?$ $\quad v_i = 0 m/s$

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

$-1.5 = 0 + \frac{1}{2}(-9.8)(t^2)$

$-3 = -9.8t^2$ or $-1.5 = -4.9t^2$

$t^2 = 3/9.8 = .306$ or $t^2 = 1.5/4.9 = .306$

$t = .55 sec$ $\quad t = .55 sec$

6. Now actually aware that his character (and actual life) is in peril, Jar Jar jumps into his land speeder (yes, one of the goofy ones from the first movie [the one Lucas calls Star Wars IV, now]). He drives 45 m/s for 20 seconds, then looks back to see them following in another speeder and drives 80 m/s for 40 seconds. Calculate the total distance he travelled and his average velocity for the whole trip. (*And just like Lucas' adjustments with new DVD releases, this story will continue...*)

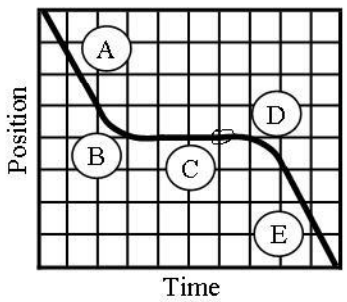
$\Delta x = 45(20) + 80(40)$

$= 900 + 3200$

$\Delta x = 4100 m$

$v_{Ave} = \frac{\Delta x}{\Delta t} = \frac{4100}{(20+40)} = 68.3 m/s$

Position vs. Time



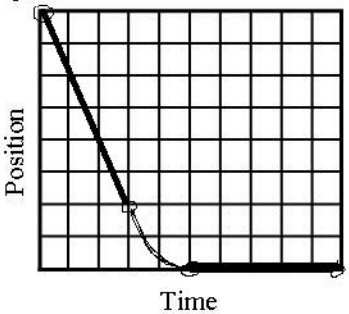
7. Assuming each square is 1 m by 1 second, calculate the average velocity for the first 6 seconds of the position vs time graph at the left.

$v_{Ave} = \frac{\Delta x}{\Delta t} = \frac{-4m}{6 sec} = -2/3 = -.67 m/sec$

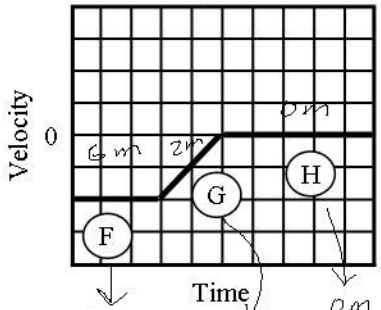
8. Use line segments A—H to answer the following. Is it +, −, or 0?

A. __−__ Δx for segment E. (left)
B. __0__ v for segment H.
C. __+__ a for segment B.
D. __+__ Δv for segment G.
E. __−__ Δx for segment D.
F. __0__ Δv for segment A.
G. __−__ v for segment F.
H. __0__ a for segment C.
I. __+__ Δv for segment B.
J. __−__ Δx for segment G.

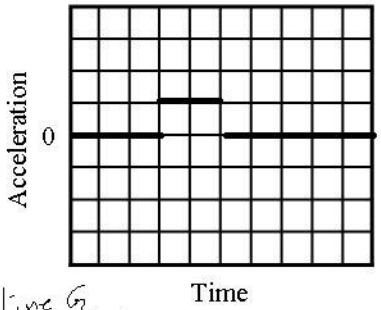
0 sec Position vs. Time



Velocity vs. Time



Acceleration vs. Time



line G: $a = \frac{0-(-2)}{2} = +1$

9. Transfer the velocity vs. time graph to the other two graphs. Assume each square is 1 m by 1 second.