Topic 2.1 – Motion **Formative Assessment**

NAME: _____ TEAM:__

THIS IS A PRACTICE ASSESSMENT. Show formulas, substitutions, answers (in spaces provided) and units!

1. A fly travels along the *x*-axis. His starting point is x = -8.0 m and his ending point is x = -16 m. His flight lasts 2.0 seconds. What is his velocity? 1. - 4.0 ms^{-1}

   $s = x - x_0 = -16 - -8 = -8$ m. $v = s / t = -8 / 2 = -4.0$ ms^{-1}.

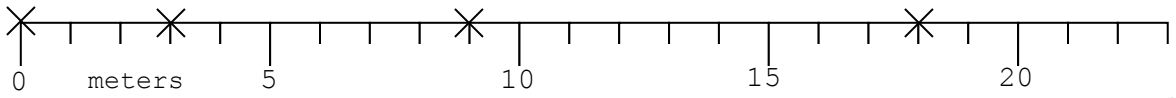
2. A car traveling at 48 ms^{-1} is brought to a stop in 3.0 seconds. What is its acceleration?

   $v = 0$, $u = 48$, $t = 3.0$. From $a = (v - u) / t = (0 - 48) / 3.0 = 16$ ms^{-2}. 2. 16 ms^{-2}

3. The acceleration of a car is – 0.75 ms^{-2}. If its initial velocity is 12.0 ms^{-1}, what is its velocity 2.5 seconds later? 3. 10. ms^{-1}

   $v = u + at = 12 + (-0.75)(2.5) = 10.125$ ms^{-1}.

At t = 0.00 s a fly is located at 0.0 m (marked with an ×). The fly is traveling in the positive x-direction. Every 0.50 seconds there is another × marking the fly's position.

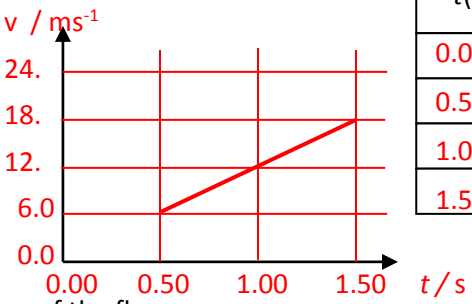


4. Complete the table: 4. See table

t(s)	*x*(m)	Δ*t*	Δ*x*	*v*
0.00	0.0			
0.50	3.0	0.50	3.0	6.0
1.00	9.0	0.50	6.0	12.
1.50	18.	0.50	9.0	18.

5. On the graph, plot the *velocities* vs. the *times* from your table.

   5. See graph



6. Find the acceleration of the fly. 6. 12 ms^{-2}

   $a = slope = rise / run = (18 - 0) / 1.50 = 12$ ms^{-2}.

Pinky and The Brain have developed a rocket that will accelerate at 16.0 ms^{-2}.

7. How fast will they be going 25.0 seconds after liftoff? 7. 400 ms^{-1}

   $v = u + at = 0 + (16)(25) = 400$ ms^{-1}.

8. How far will they have gone 25.0 seconds after liftoff? 8. 5000 m

   $s = ut + (1/2)at^2 = 0(25) + (1/2)(16)(25^2) = 5000$ m.

A bowling ball is launched upward with an initial speed of 25.0 ms^{-1}.

9. How long will it take to reach its maximum height? 9. 2.5 s

   $v = u + at \rightarrow t = (v - u)/a = (0 - 25) / -10 = 2.5$ s.

10. How far above its launch point will it go up? 10. 31 m

    $s = ut + (1/2)at^2 = (25)(2.5) + (1/2)(-10)(2.5^2) = 31.25$ m.

11. How long will it be in the air before returning to its launch point? 11. 5.0 s

    $s = ut + (1/2)at^2 \rightarrow 0 = (25)t + (1/2)(-10)t^2 \rightarrow t = 5.0$ s. Note that $t_{up} = t_{down}$.

A bowling ball is dropped from a balcony on the Tower of Pisa that is 18 m above the ground.

12. How long will it take to reach the ground? 12. 1.9 s

$s = ut + (1/2)at^2 \rightarrow -18 = (0)t + (1/2)(-10)t^2 \rightarrow t = 1.897$ s.

13. What will its speed be when it reaches the ground? 13. -19 ms^{-1}

$v = u + at = 0 + (-10)(1.897) = -18.97\ ms^{-1}$.

A bowling ball is thrown downward at 22 ms^{-1} from a balcony on the Tower of Pisa that is 18 m above the ground.

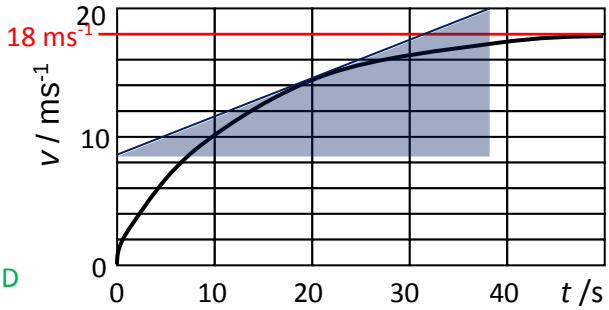
14. What will its speed be when it reaches the ground? 14. 29 ms^{-1}

$v^2 = u^2 + 2as = 22^2 + 2(-10)(-18) \rightarrow v = 29.05\ ms^{-1}$.

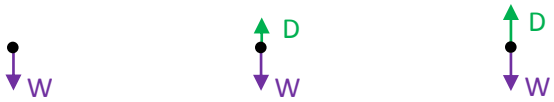
15. How long will it take to reach the ground? 15. 1.4 s

$v = u + at \rightarrow t = (v - u)/a = (-29.05 - -15)/-10 = 1.405$ s.

A whale is in free-fall. Her speed vs. time is plotted in the graph.



16. Draw labeled free-body diagrams of the whale at the times $t = 0$ s, $t = 10$ s, and $t = 50$ s.



17. What is her terminal speed? 17. 18 ms^{-1}

From graph : 18 ms^{-1}.

18. What is her instantaneous acceleration at $t = 20$ s? 18. 0.30 ms^{-2}

From graph : *a = slope of tangent*

a = rise / run = $(20 - 8.5)/38 = 0.3026\ ms^{-2}$.

19. What does the area under a velocity vs. time graph tell you? 19. The displacement

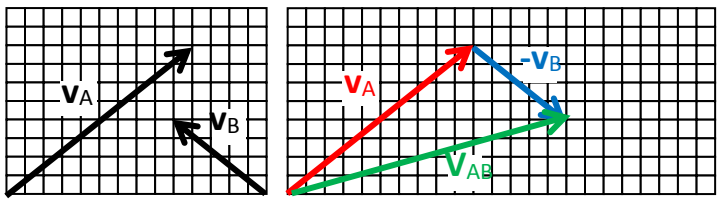
20. What does the slope of a velocity vs. time graph tell you? 20. The acceleration

21. What does the area under an acceleration vs. time graph tell you? 21. The velocity change

Two cars A and B are driving at velocities represented below as scale arrows.

22. Sketch accurately the vector representing the velocity of A relative to B on the grid provided. Make it the same scale. 22. See graph

$\mathbf{V_{AB}} = \mathbf{V_A} - \mathbf{V_B} = \mathbf{V_A} + (-\mathbf{V_B})$.



23. If the grid lines in the previous graph represent 2.0 ms^{-1} increments, find the magnitude of the vector you drew representing the velocity of A relative to B. Be very exact! 23. 31 ms^{-1}

$V_{AB,x} = 15 \times 2\ ms^{-1}$. $V_{AB,y} = 4 \times 2\ ms^{-1}$. Thus $V_{AB}^2 = 30^2 + 8^2 \rightarrow V_{AB} = 31.04\ ms^{-1}$.