[**VISUAL PHYSICS ONLINE**](http://www.physics.usyd.edu.au/teach_res/hsp/sp/spHome.htm)

**1: Kinematics**

Images ex1/ex01.pptx

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| Two bike riders have their velocities measured as they travel along a straight track. The measurements are plotted in the graph below where at time *t* = 0 s, the two riders are side by side.    Answer **true** or **false** for the following statements when time *t =* 30 s.  A They are again side by side.  B They have identical accelerations.  C Rider X is travelling faster than rider Y.  D Rider X has travelled further than rider Y.  Justify each answer.  Did any of your answers change after doing the following calculations.  Calculate the following   1. Distance travelled by both riders in 30 s. 2. Maximum acceleration (magnitude) of both riders. 3. Velocity of both riders after 25 s. 4. The time at which bike X stops. What assumption did you need to make?   **A** FALSE: Area under v/t graph gives the displacement. So, the area under the graphs for the 30 s time interval are not equal, therefore they have travelled different distances.  **B** FALSE: The slope of the tangent to the v/t graph equals the velocity. After 30 s, rider Y has zero acceleration and rider X has a negative acceleration.  **C** FALSE: After 30 s the two riders has identical velocities.  **D**  TRUE: Area under v/t graph gives the displacement. The area under the v/t graph for rider X is greater than the area for rider Y, hence rider X has a travelled a greater distance.  (1)  Area under v/t graph gives the displacement.  Rider X area = (10)(20)+(10)(5)+(1/2)(10(5) = 275  Rider Y area = (30)(5) = 150  Distance travelled by rider X is 275 m  Distance travelled by rider Y is 150 m  (2)  The slope of the tangent to the v/t graph equals the acceleration.  Rider Y travels at a constant velocity, so their acceleration is zero.  Rider X travels at a constant velocity, so their acceleration is zero in the time interval from 0s to 20 s.  Rider X has a negative acceleration in the interval from 20 s to 30 s.    Maximum magnitude for the acceleration is 0.5 m.s-2.  (3)  Both riders have the same velocity after 30 s    (4)  Assume rider X continues to move with the constant acceleration .    So, the rider X will stop after 40 s. This is confirmed by inspecting the graph. |

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| A ship sails 60 km due east in 3.0 hours and then 45 km due north in the next 2.0 hours.  Calculate the following after the 5.0 hours:   1. The distance travelled by the ship. 2. The displacement of the ship. 3. The average speed of the ship. 4. The average velocity of the ship. |

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| The acceleration and braking capabilities of a new car are being tested. The driver accelerates from rest to 8.0 m.s-1 for 4.0 s. The driver then travels at a constant velocity for 2.0 s and then, by applying the brakes with an even pressure, stops the car in 3.0 s.  Draw a v/t graph for the motion of the car.  From the data given in the questions, what are all the interesting things that you can calculate?    The slope of the tangent to the v/t graph equals the acceleration.  Area under v/t graph gives the displacement.  (1) interval 0 s to 4 .0 s    (2) interval 4.0 s to 6 .0 s    (3) interval 6.0 s to 9 .0 s    The total displacement of the car from its starting position is |

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| Two balls are launched from the top of a cliff. Ball A has an initial velocity of 8.00 m.s-1 at an angle of 30.0o w.r.t. the horizontal and ball B has an initial velocity of 12.0 m.s-1 at 60.0o to the horizontal. The height of the cliff above sea level is 100 m.  Ignoring air resistance, calculate:   1. The time taken for both ball to reach their maximum heights. 2. The maximum heights of the balls above sea level. 3. The speed of the balls at their maximum height. 4. The relative position of ball B when ball A is at its maximum height. 5. The relative velocity of ball B when ball A is at its maximum height. 6. The horizontal distance from the base of the cliff that the balls enter the sea water, 7. The velocities of the balls as they enter the sea water. |