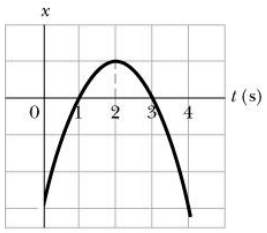
AP Physics Study Guide Chapters 1 – 3 **Name**_____

Circle the vector quantities below and underline the scalar quantities below
Distance Acceleration Velocity Speed Displacement

Write the equation that defines each quantity, INCLUDING UNITS FOR ALL QUANTITIES.

Displacement Velocity Acceleration

On the position – time graph below draw 2 lines which will enable you to calculate the average velocity of the object's motion between 0 and 3 seconds and its instantaneous velocity at 2 seconds. The _____ of each line will yield the magnitude of each velocity.

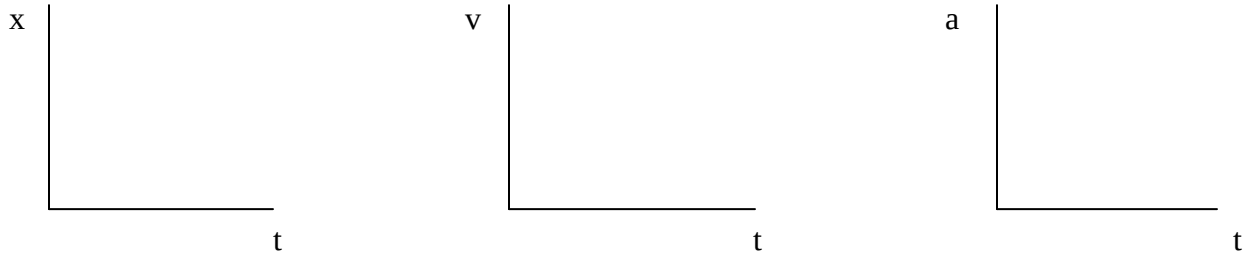


The _____ a velocity – time graph is equal to the displacement for a certain time interval. The _____ of a velocity – time graph is equal to average acceleration.

Write the 4 kinematic equations that define motion with constant acceleration.

1) 2) 3) 4)

Draw the shape of each graph for motion with constant acceleration.

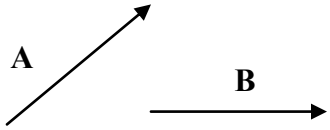


Write the 4 basic conditions that are associated with an object in free fall near the Earth's surface

1) 2)

3) 4)

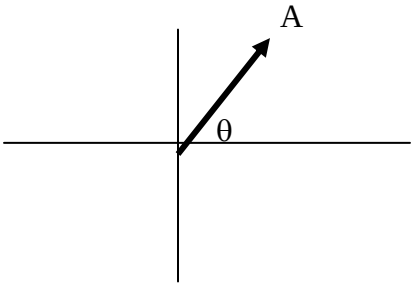
Two displacement vectors **A** and **B** are shown at right.



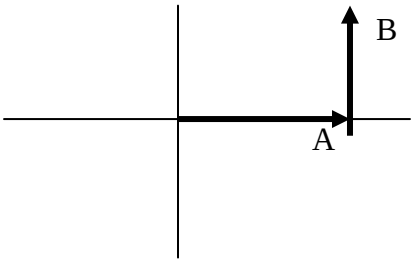
Draw a tip-to-tail vector diagram showing vector addition of A and B

Draw a tip-to-tail vector diagram showing vector subtraction of A and B

Draw the x and y components of vector A on the diagram below. Write the two equations required to calculate A_x and A_y using trig functions.



Draw the resultant vector R for vectors A and B below. Write the two equations required to determine the magnitude and direction of R



Write the three conditions for an object that is in projectile motion

1)

2)

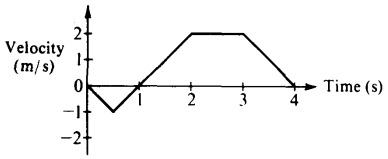
3)

Write the 2 equations that define motion of a projectile in the horizontal (x) direction
1) 2)

Write the 3 equations that define motion of a projectile in the vertical (y) direction
1) 2) 3)

The shape of the trajectory of a projectile is _____.

Show a brief amount of process or provide an explanation for each question. Put your answer on the lines provided along the right margin.



1) The graph above shows the velocity versus time for an object moving in a straight line. At what time after t = 0 does the object again pass through its initial position?

(A) Between 0 and 1 s (B) 1 s (C) Between 1 and 2 s (D) 2s (E) Between 2 and 3 s

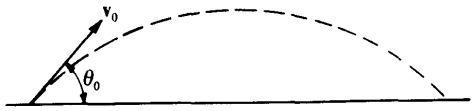
1)_____

2) A diver initially moving horizontally with speed v_e dives off the edge of a vertical cliff and lands in the water a distance d from the base of the cliff. How far from the base of the cliff would the diver have landed if the diver initially had been moving horizontally with speed $2v$?

(A) d (B) $\sqrt{2d}$ (C) $2d$ (D) $4d$

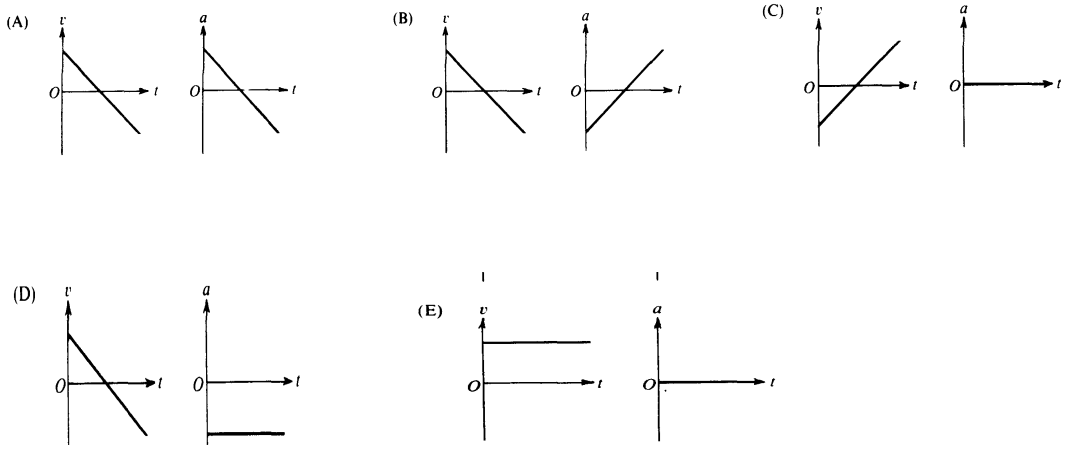
(E) can't be determined without knowing the height of the cliff

2)_____



3) A projectile is fired with initial velocity v_o at an angle θ_0 with the horizontal and follows the trajectory shown above. Which of the following pairs of graphs best represents the vertical components of the velocity and acceleration. v and a, respectively, of the projectile as functions of time .

3)_____



4) A body moving in the positive x direction passes the origin at time t = 0. Between t = 0 and t = 1 second, the body has a constant speed of 24 meters per second. At t = 1 second, the body is given a constant acceleration of 6 meters per second squared in the negative x direction. The position x of the body at t = 11 seconds is

(A) +99m (B) +36m (C) - 36 m (D) - 75 m (E) - 99 m 4)_____

5) In the absence of air resistance, an object dropped near the surface of the Earth experiences a constant acceleration of about 9.8 m/s^2. This means that the

A) speed of the object increases 9.8 m/s during each second 5)_____

B) speed of the object as it falls is 9.8 m/s

C) object falls 9.8 meters during each second

D) object falls 9.8 meters during the first second only

E) derivative of the distance with respect to time for the object equals 9.8 m/s^2

1) The first 10 meters of a 100-meter dash are covered in 2 seconds by a sprinter who starts from rest and accelerates with a constant acceleration. The remaining 90 meters are run with the same velocity the sprinter had after 2 seconds.

a. Determine the sprinter's constant acceleration during the first 2 seconds.

a)_____

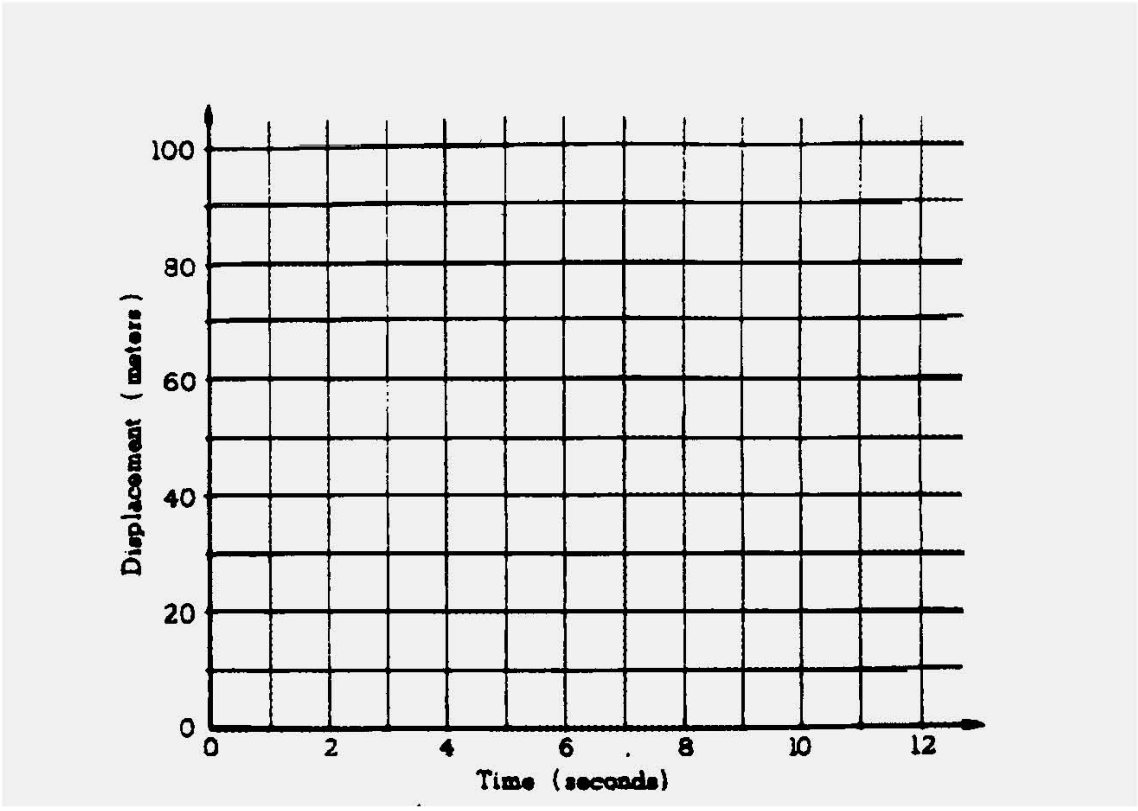
b. Determine the sprinter’s velocity after 2 seconds have elapsed.

b) _____

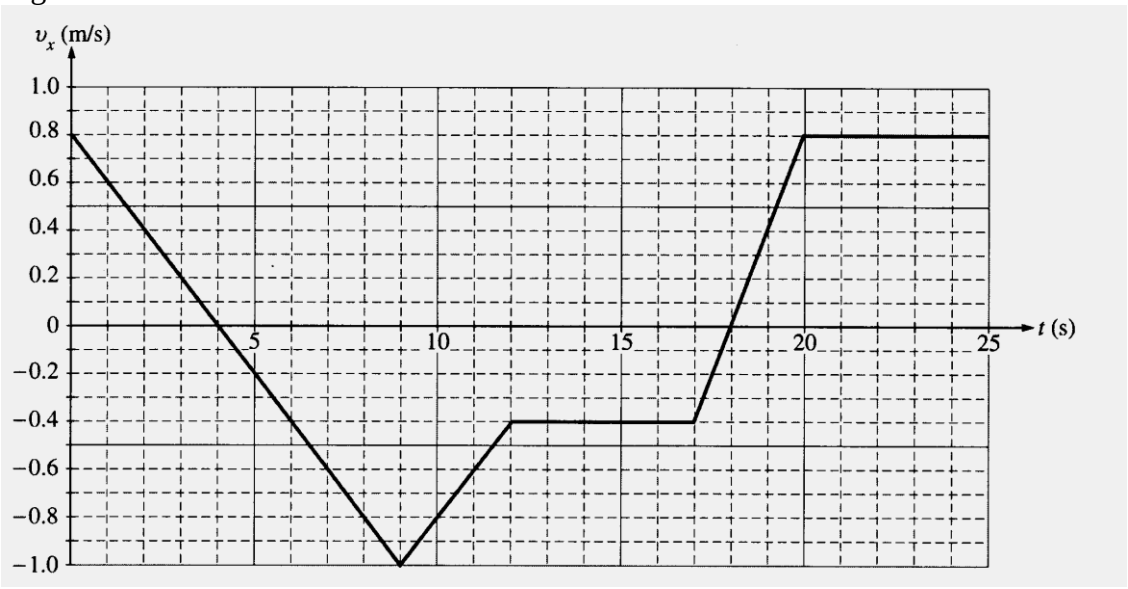
c. Determine the total time needed to run the full 100 meters.

c)_____

d. On the axes provided below, draw the displacement vs. time curve for the sprinter.



2) A 0.50 kg cart moves on a straight horizontal track. The graph of velocity *v* versus time *t* for the cart is given below.



a. Indicate every time t for which the cart is at rest.

a)_____

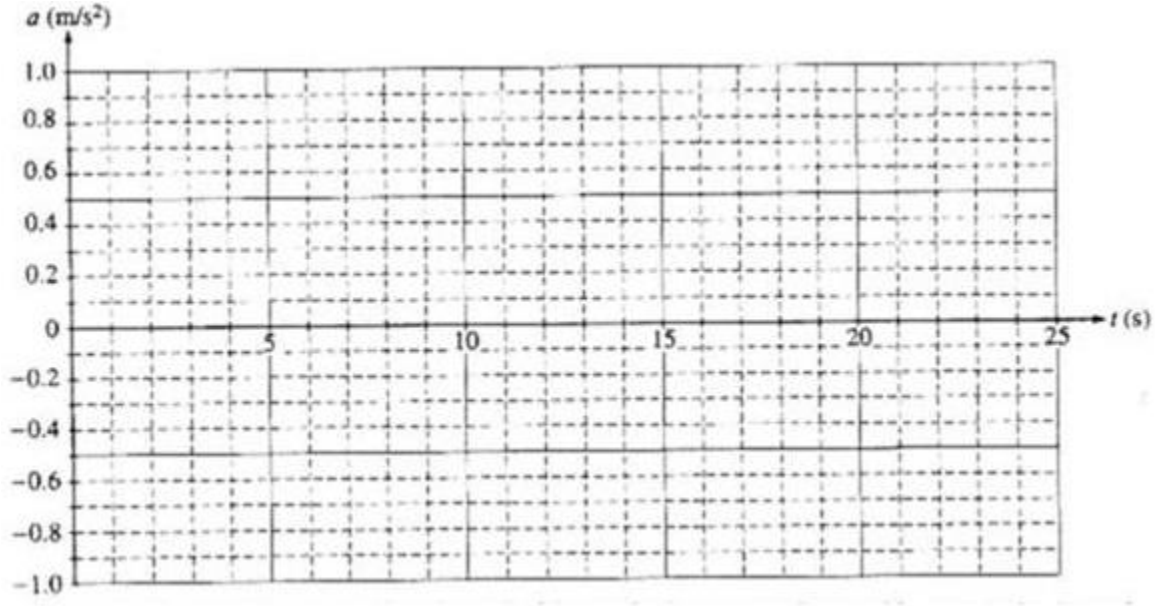
b. Indicate every time interval for which the speed (magnitude of velocity) of the cart is increasing.

b)_____

c. Determine the horizontal position x of the cart at t = 9.0 s if the cart is located at x = 2.0 m at t = 0.

c)_____

d. On the axes below, sketch the acceleration a versus time t graph for the motion of the cart from t = 0 to t = 25 s.

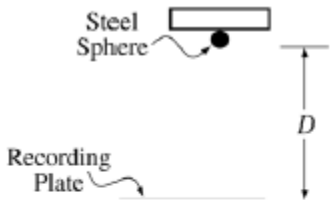


e. From t = 25 s until the cart reaches the end of the track, the cart continues with constant horizontal velocity. The cart leaves the end of the track and hits the floor, which is 0.40 m below the track. Neglecting air resistance, determine each of the following:
i. The time from when the cart leaves the track until it first hits the floor

i)_____

ii. The horizontal distance from the end of the track to the point at which the cart first hits the floor

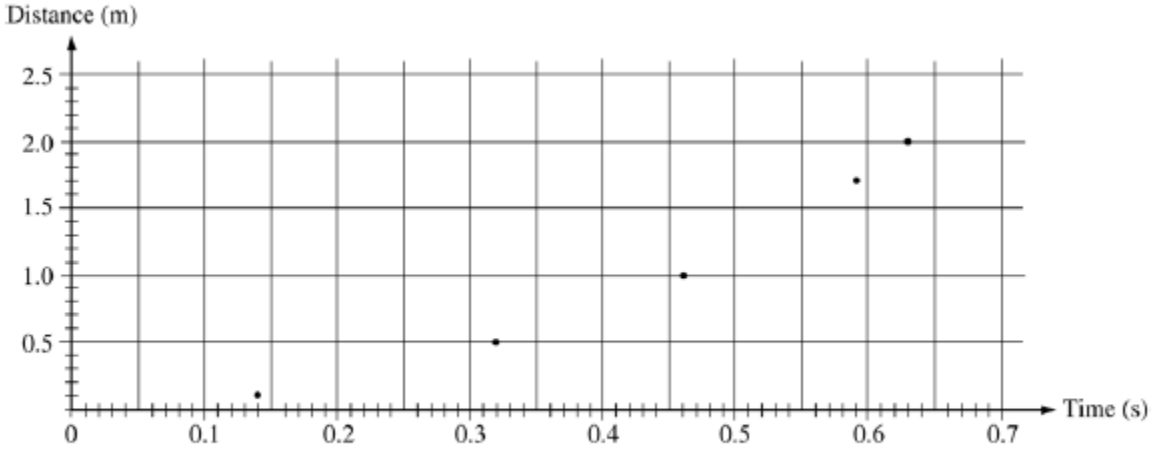
ii)_____



3)

A student wishing to determine experimentally the acceleration g due to gravity has an apparatus that holds a small steel sphere above a recording plate, as shown above. When the sphere is released, a timer automatically begins recording the time of fall. The timer automatically stops when the sphere strikes the recording plate. The student measures the time of fall for different values of the distance D shown above and records the data in the table below. These data points are also plotted on the graph.

Distance of Fall (m)	0.10	0.50	1.00	1.70	2.00
Time of Fall (s)	0.14	0.32	0.46	0.59	0.63



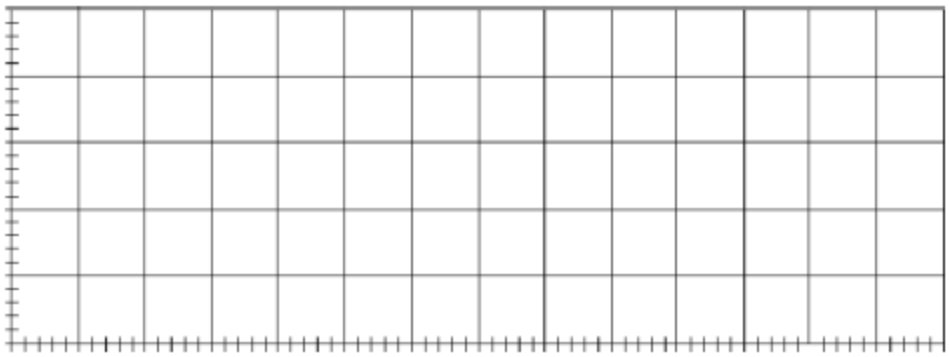
(a) On the grid above, sketch the smooth curve that best represents the student's data.

The student can use these data for distance D and time t to produce a second graph from which the acceleration g due to gravity can be determined.

b) If only the variables D and t are used, what quantities should the student graph in order to produce a linear relationship between the two quantities?

b)_____

(c) On the grid below, plot the data points for the quantities you have identified in part (b), and sketch the best straight-line fit to the points. Label your axes and show the scale that you have chosen for the graph.



(d) Using the slope of your graph in part (c), calculate the acceleration g due to gravity in this experiment.

d)_____

e) State one way in which the student could improve the accuracy of the results if the experiment were to be performed again. Explain why this would improve the accuracy.