You may use a 5” x 8” index card or sheet of paper as notes or formula sheet.

Questions 1 through 10 are worth 4 points each. Questions 11,12 and 13 are worth 20 pts. each.

Answer 1 through 10 on the Scantron sheet. Answers for the work-out problems (11,12,13) are to be answered on this form. To receive credit for correct answer you must show your work.

For the following ten questions select the correct or best answer, circle it on this form and fill in the corresponding space on the Scantron sheet. In case of a discrepancy the answer on the Scantron will be use for your test score.

For problems 1 through 10 use \( g = 10.0 \text{ m/s}^2 \).

1) In the formula, \( y = \frac{a}{t^3} \), \( y \) is expressed in meters (m) and \( t \) is expressed in seconds (s). The units in which ‘a’ is expressed is:
   A) \( t^3 \)
   B) \( t^{-3} \)
   C) \( m^{-1} t^3 \)
   D) \( m^{-1} t^{-3} \)
   E) m

2) One (1) mile equals 8 furlongs. One fortnight equals fourteen days. 5600 furlongs per fortnight is closest to how many miles per day?
   A) 627200
   B) 9800
   C) 5600
   D) 3200
   E) 50

3) An automobile accelerates uniformly from 12.0 m/s to 30.0 m/s in 5.00 seconds. The distance traveled in these 5.00 seconds equals:
   A) 60.0 m
   B) 75.0 m
   C) 90.0 m
   D) 105.0 m
   E) 150.0 m

4) A baseball is dropped, not thrown, from a window to someone waiting on the ground. The ball reaches the person with a speed of 40.0 m/s. From what height was the ball dropped? Neglect the effect of air resistance.
   A) 20 m.
   B) 40 m.
   C) 60 m.
   D) 80 m.
   E) 100 m.
A car accelerated uniformly at was its velocity as it passed the 150 mark.

A) \( \frac{V}{2} \)
B) \( \frac{V}{2^{1/2}} \)
C) \( 2^{1/2} V \)
D) \( 2V \)
E) Not enough information to determine.

5) Three vectors have the following magnitudes and directions \( \mathbf{A} \) (100 m @ 45°), \( \mathbf{B} \) (200 m @ 135°) and \( \mathbf{C} \) (100 m @ 270°). The resultant vector of these three has an x – component of:

A) –112.1 m
B) –70.71 m
C) 0.00
D) 70.71 m
E) 112.1 m

7) Vector \( \mathbf{A} = 3\mathbf{i} - 2\mathbf{j} + \mathbf{k} \). Vector \( \mathbf{B} = \mathbf{i} + 4\mathbf{j} - 3\mathbf{k} \). The scalar, or dot, product \( \mathbf{A} \cdot \mathbf{B} \) equals:

A) \( 3\mathbf{i} - 8\mathbf{j} - 3\mathbf{k} \)
B) \( 4\mathbf{i} + 2\mathbf{j} - 2\mathbf{k} \)
C) 2
D) 4
E) 14

8) A certain softball player can throw a softball at 30.0 m/s. Assuming she releases the ball with an initial angle of 45 degrees above the horizontal, How far away must her teammate stand in order to catch the ball at the same height it left the thrower’s hand?

A) 22.5 m.
B) 45.0 m.
C) 75.0 m
D) 90.0 m.
E) 180 m.

9) The maximum height reached above the thrower’s hand by the ball is:

A) 22.5 m.
B) 45.0 m.
C) 75.0 m
D) 90.0 m.
E) 180 m.

10) The speed of the ball as it passes through the maximum height is;

A) 0.00 m/s.
B) 10.6 m/s.
C) 15.0 m/s.
D) 21.2 m/s.
E) 30.0 m/s.
11) Two cars are stopped side-by-side at a starting line. Car A begins to accelerate at 1.50 m/s². Several seconds later car B begins to accelerate at 2.50 m/s in the same direction as A. At 1000 meters from the starting line car B overtakes car A.

A) How many seconds after car A’s start did car B begin to move?

B) Calculate the velocity of each car as car B catches up to car A.

C) How far was car A from B when B began to move?

D) Sketch, not plot, the motions of cars A and B on the same set of axes for x vs t and v vs t. On each axis insert appropriate values.
12) John walks 250 meters in a direction of 30° and then walks 250 meters in a direction of 90°. Meanwhile his friend Florence walks 150 meters @ 75° and then 400 meters @ 240°.
A) Calculate the magnitude and direction of John’s position vector.

B) Calculate the magnitude and direction of Florence’s position vector.

C) If John wants to meet Florence, in what direction and how far must he walk?

D) Sketch the three vectors on a set of axes.
12) You are standing 40.0 meters from the base of a 16.5 meter high vertical wall. You then throw a ball at 30° above the horizontal and it leaves your hand at a height of 1.50 meters above the ground.

A) With what speed must you throw the ball so it just clears the top of the fence?

B) How much time will elapse before the ball reaches the fence.

C) What are the horizontal and vertical components of the ball’s velocity as it passes the top of the fence?

D) What is the magnitude and direction of the ball’s velocity as it clears the fence.

E) Does the ball clear the fence on the way up or down? Explain your choice.