True False questions. Circle the best answer. (1 mark each)

1) Adding 2 vectors **can** give you a resultant vector with a magnitude of 0.
a) True   b) False

2) A ball in 2D projectile motion will have zero (0m/s) velocity at its maximum height
a) True   b) False

3) As you are rowing your boat directly across the river at 2m/s, a current is pushing your boat west. Your travel time was 10s to cross the river. If there was no current, you would take more than 10s to cross the river rowing at 2m/s.
a) True   b) False

4) A cart is being pulled along a horizontal track by an external force (a weight hanging over the table edge) **and accelerating**. It fires a ball straight out of the cannon vertically as it moves. After it is fired, it falls in the cart.
a) True   b) False

5) An object's initial velocity's vertical component affects the range of its projectile motion in 2D.
a) True   b) False

Multiple choice questions. Circle the best answer. (1 mark each)

6) You drop a rock off a bridge. When the rock has fallen 4 m, you drop a second rock. As the two rocks continue to fall, what happens to their distance of separation?
a) Their distance apart increases as they fall
b) Their distance apart stays constant
c) Their distance apart decreases as they fall
d) Not enough info

7) A small cart is rolling at constant velocity on a flat track. It fires a ball straight up into the air as it moves. After it is fired, it falls right back at the cart. Why?
a) The ball's vertical component of its initial velocity is the same as the moving cart
b) The ball's horizontal component of its initial velocity is the same as the moving cart
c) Gravity is acting on the ball
d) B and C
e) All of the above

8) From the *same* height (and at the *same* time), one ball is dropped and another ball is fired horizontally. Which one will hit the ground first?
a) The "dropped" ball
b) The "fired" ball
c) They both hit at the same time
d) It depends on how hard the ball was fired
e) It depends on the initial height

9) A cannon fired a cannonball on Earth and the projectile followed path 2. On the Moon where g = 1.6 m/s^2, which path would the cannonball take in the same situation?
a) 1   b) 2   c) 3
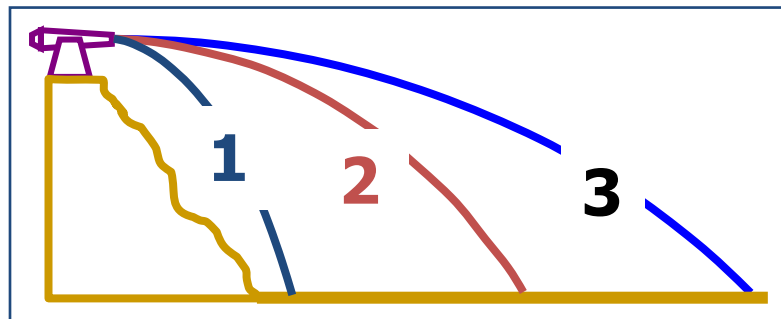
10) You fire an arrow with v_o = 100m/s at 50° up from the horizontal (ground). The final velocity of the arrow before it hits the ground again is:
a) 100m/s at a 50° angle right from the vertical   b) 100m/s at a 50° angle down from the horizontal
c) 100m/s at a 40° angle down from the vertical   d) 100m/s at a 40° angle down from the horizontal

Written section. Please show all your work.

11) You can row your canoe at 9.2m/s in still water. The current of the river flows west at 4.2m/s. If the width of the river is 30m, find:
a) In which direction should you row your canoe if you want your canoe to move directly south across the river from where you started? *(3 marks)*
b) How long does it take to get to the other side in a)? *(2 marks)*

a) $27°$ East of South OR

$63°$ South of East

b) $3.7s$

12) A plane drops a package at h = 1250m above the ground. The plane was flying at v_0 = 256m/s before it dropped the package. Find:
a) The time it takes the package to land on the ground. *(3 marks)*
b) Distance D between the island and where the plane dropped the package. *(2 marks)*

a) $16 s$

b) $4100m$