CORPUS CHRISTI COLLEGE
SEQUERE DOMINUM

Year 12 ***ATAR* Physics Unit 3** **2017**

Test 1 ***Projectile Motion,*** ***3.0%***

NAME: ……

Data: See Data Sheet
Approx. marks shown.

(56 marks)

When calculating numerical answers, show your working or reasoning clearly. Give final answers to **three** significant figures and include appropriate units where applicable.

When estimating numerical answers, show your working or reasoning clearly. Give final answers to a maximum of **two** significant figures and include appropriate units where applicable.

1. A person on the tray of a truck travelling at 40.0 kmh^{-1} in a straight line throws a ball straight up at 8.00 m s^{-1} and catches it again at the same height. What horizontal displacement does the ball undergo whilst in flight? [4]

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2. A cannon fires a cannon ball horizontally at speed of 50.0 m s^{-1} from the top of a bridge that is 100 m above the surface of a lake below. Ignoring air resistance, calculate the velocity of the cannon ball just before it hits the water. [5]

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3. A cricket ball (hit from near the ground) strikes the ground just over the boundary 110 m from the batsman. A spectator estimates that the ball rose to a maximum height of 25 m.
Use calculations to estimate the velocity with which the ball left the bat. [6]

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4. An arrow is fired at 30.0° above the horizontal with a speed of 90.0 m s^{-1}. Neglect air resistance and consider the arrow to be a point mass.

(a) (i) At what instant in time after firing will the arrow be travelling the slowest? [2]

Figure 1

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(ii) What is the velocity of the arrow at this instant of time? [2]

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(b) Even though the target is at the same level as the bow when the arrow is released the arrow is not fired directly along the line of sight (the **blue line** in Figure 2 below). Briefly explain the reason for this. [3]

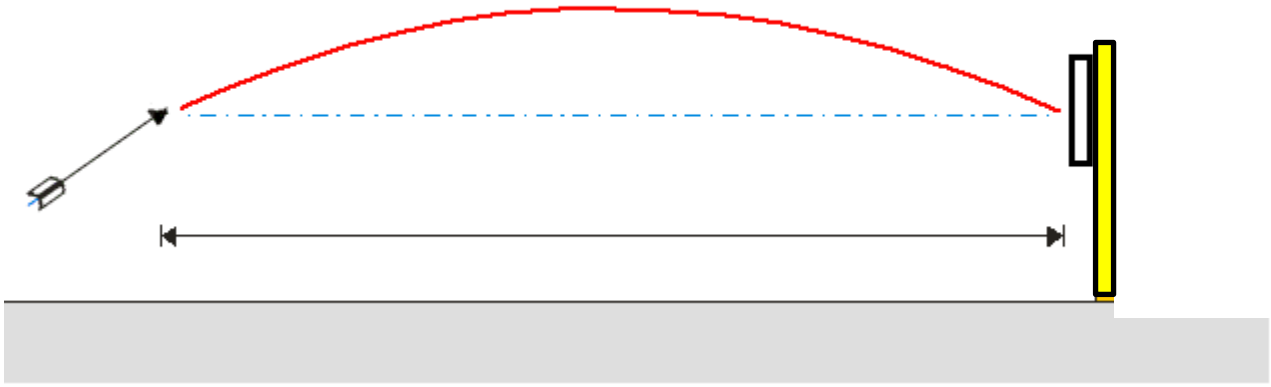

Figure 2

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(c) At what different angle could the arrow be fired to achieve the same range? Show the trajectory on **Figure 2** [2]

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5. On February 6 1971, during the Apollo 14 mission, astronaut Alan Shepard hit a golf ball on the Moon. The golf club launched the ball at an angle of 24° to the ground with an initial speed of 45 m s^{-1}.

(a) Construct a labelled free body diagram below, showing the force(s) acting on the golf ball about halfway between it being struck and its highest point. [2]

(b) Calculate the horizontal and vertical components of the initial velocity. [2]

Answer u_h ……m s^{-1}

Answer u_v ……m s^{-1}

(c) Assuming the golf ball travelled over a level surface, a horizontal distance of 900 m, calculate

(i) time taken to hit the surface [2]

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(ii) the value of the acceleration due to gravity on the Moon [4]

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6. An explosion in a tall building projects window glass outward *and downward* at 40.0 m s^{-1} at an angle of 20.0° below the horizontal. If the glass strikes the ground 4.50 s later,

(a) how far from the ground was the room in which the explosion occurred, and [3]

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(b) how far from the base of the building does the glass land? [3]

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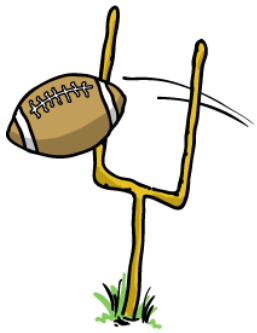
7. In a football game, a place kicker kicks a football from the ground at a distance of 36.0 m from the goalposts, and the ball must clear the crossbar which is 3.10 m from the ground as shown in the diagram.



When kicked, the ball leaves the foot at 20.0 m s^{-1} at an angle of 53 0° to the horizontal.

(a) How long does the ball take to travel the distance to the goalposts? [3]

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(b) How far above or below the crossbar is the ball when it passes through the goal posts? [4]

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(c) Show on a sketch the path of the football. Include the goalposts in your sketch. Explain why you have drawn the path this way, *showing any necessary working*.

Label this path P. [5]

(d) On the sketch in (c) above sketch the path of the football would take if air resistance was not negligible.

Label this path A. [2]

(e) On the sketch in (c) above sketch the path of the football would take if a tail-wind was present and the air resistance was negligible.

Label this path W. [2]

End of Test