Name:_____

Assignment due:

St Patrick's College, Silverstream

PHYSICS

Mechanics Assignment 5

Projectiles

Level 2

90255 Demonstrate understanding of mechanics

You may find the following formulae useful

$$v = \frac{\Delta d}{\Delta t} \qquad a = \frac{\Delta v}{\Delta t} \qquad v_f = v_i + at$$

$$d = v_i t + \frac{1}{2}at^2 \qquad d = \frac{v_i + v_f}{2}t \qquad v_f^2 = v_i^2 + 2ad$$

$$a_c = \frac{v^2}{r}$$

$$F = ma \qquad \tau = Fd \qquad F = -kx$$

$$F_c = \frac{mv^2}{r} \qquad p = mv \qquad \Delta p = F\Delta t$$

$$E_p = \frac{1}{2}kx^2 \qquad E_k = \frac{1}{2}mv^2 \qquad \Delta E_p = mg\Delta h$$

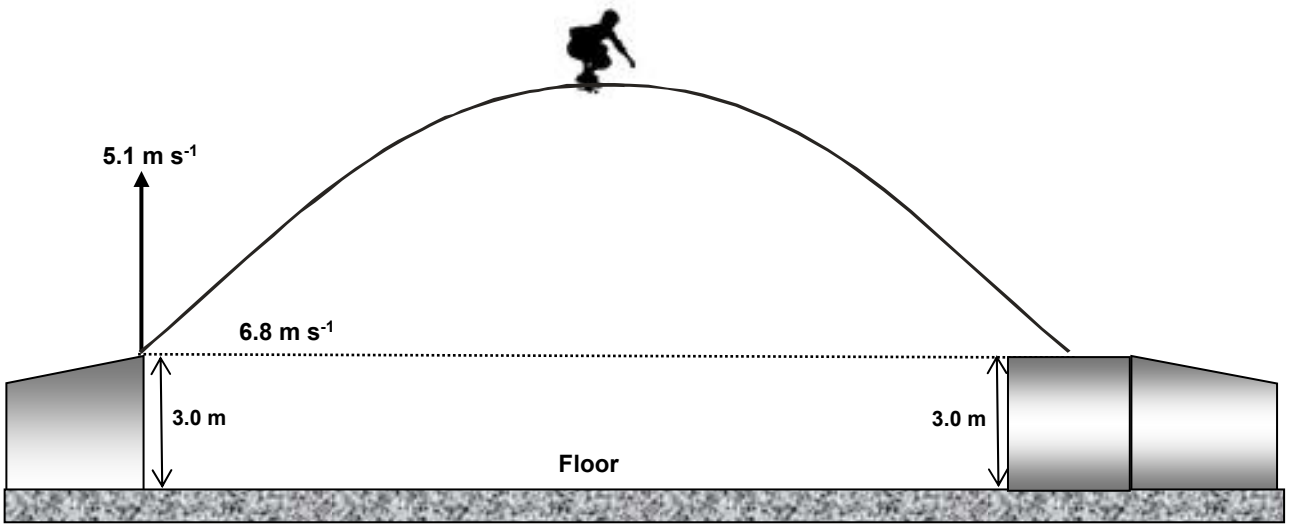
$$W = Fd \qquad P = \frac{W}{t}$$

$g = 9.8 ms^{-2}$

NZIP 2008

QUESTION TWO: SKATEBOARD SKILLS AND THRILLS

Monica is performing a jump in a skateboarding competition. She jumps across the gap between two ramps as shown in the diagram below. Her initial vertical velocity for the jump is 5.1 ms^{-1} and her horizontal velocity across the gap is 6.8 ms^{-1} and. She lands at the same horizontal level as her take off point.



(e) Calculate the horizontal distance (range) travelled by Monica across the ramps.

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_____

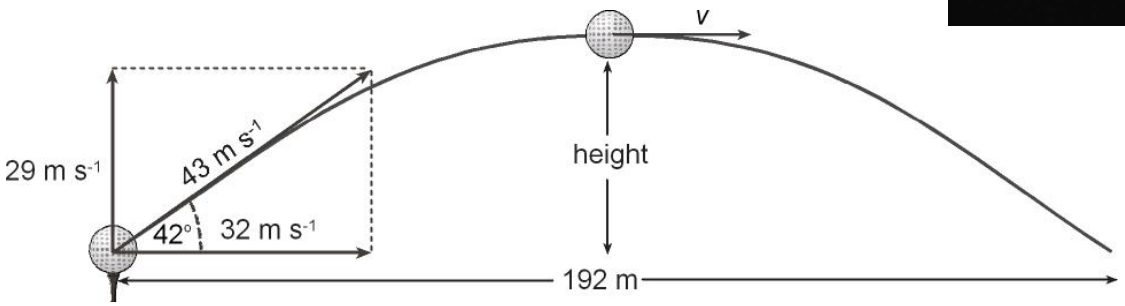
distance = _____

NZIP 2007

QUESTION THREE: PROJECTILE MOTION

Hannah is a golfer. She hits a golf ball. The diagram below shows the flight of the golf ball, which leaves the tee at a speed of 43 m s^{-1} at an angle of 42° to the horizontal direction.

You can assume there is no air resistance. Acceleration due to gravity = 9.8 m s^{-2}.



(a) Show that the **horizontal component** of her **initial velocity** is 32 m s^{-1}.

(b) Show that the **vertical component** of her **initial velocity** is 29 m s^{-1}.

(c) Determine the **speed** *v* of the golf ball at the highest point. **Explain your reasoning**.

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_____

(d) State the **size** and **direction** of the golf ball's **acceleration** at the highest point.

Size: _____

Direction: _____

(e) The horizontal distance covered by the flight of the golf ball is 192 m. Calculate the **time of flight** of the golf ball.

_____

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_____

(f) Calculate the **maximum vertical height** of the golf ball's flight.

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NZIP 2006

QUESTION TWO: THE BATTER IN TROUBLE

(d) The Third bowl was a 'bouncer'. The ball struck the batter on the helmet, bounced vertically up into the air at a speed of **$19ms^{-1}$** before falling back to the ground. Show that the ball travelled a height of **18m** above the helmet.

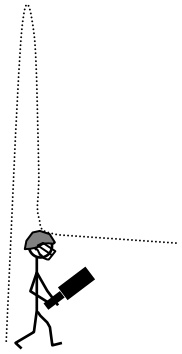
_____

_____

_____

_____m

(e) Complete the diagram on the right by adding all the information you know or need to know in order to calculate the time from when the ball first struck the helmet until it hit the ground. The ball was **1.7m** above the ground when it struck the helmet.



(f) Calculate the time from when the ball first struck the helmet until it hit the ground.

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_____

_____

_____

_____ Time = _____

NZIP 2006
QUESTION THREE: BIG HITTER

(b) Later the batter hit the ball into the air. The ball left the bat travelling at a speed of **$36ms^{-1}$** and at an angle of **43^{o}** to the ground.

(i) Show that the initial velocity of the ball is $24.55ms^{-1}$ (unrounded).

_____

_____

(ii) Show that the initial horizontal velocity of the ball is $26.33ms^{-1}$ (unrounded).

_____

_____

(c) Calculate the velocity of the ball **1.5s** after it is hit.

_____

_____

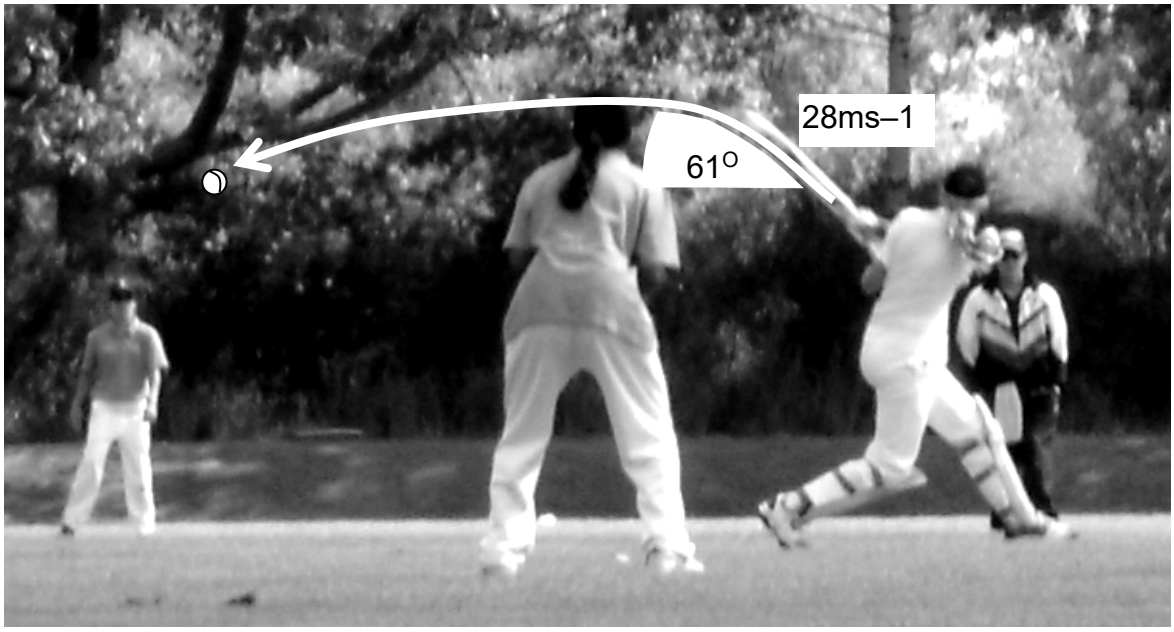
_____

_____

_____

_____ Velocity (1.5s) = _____

(d) Later still the batter hit the ball in the air again. The ball was hit in a line toward a fielder standing **43m** away from the batter. The ball left the bat travelling at **28ms^{-1}** at an angle of **61^{O}**. The ball bounced once before the fielder retrieved it. Which way did the fielder have to move in order to get to where the ball bounced? Your answer must be sufficiently supported by your working.



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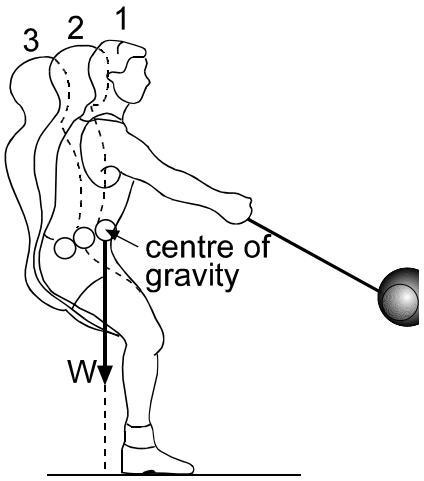
The fielder moved *towards / away* from the batter. *(circle the correct direction)*

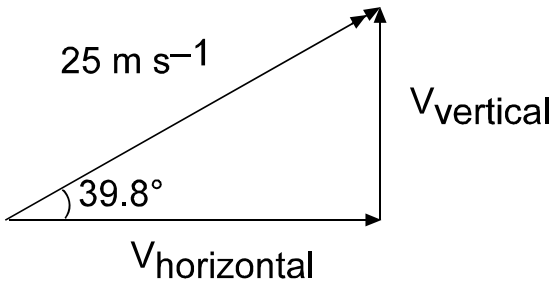
NZIP 2005

QUESTION TWO: The hammer throw

A 'hammer' is a ball of mass 7.26kg on the end of a wire and handle.



As the hammer is released, the ball is moving 25 ms^{-1} at an angle of 39.8° to the horizontal.



(c) Show that the horizontal component of the velocity of the ball as it is released is 19ms^{-1}

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(d) Show that the vertical component of the velocity of the ball as it is released is 16ms^{-1}

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_____

After release, the hammer is in the air for 3.2 s before landing.

(e) Calculate the distance of the throw.

_____

_____

_____

_____Distance = _____

(f) Calculate the maximum height reached by the hammer during its flight.

_____

_____

_____

_____Maximum height = _____

(g) State the forces acting on the hammer during its flight.

_____

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(h) Describe the motion of the hammer during its flight.

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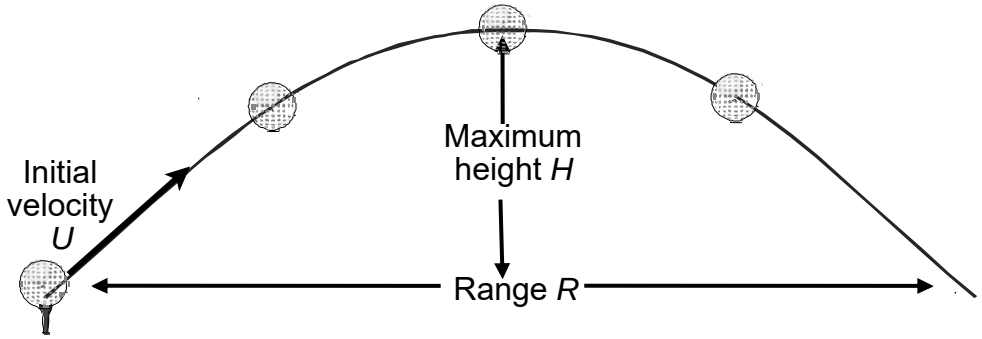
NZIP 2004

QUESTION ONE: THE FLIGHT OF A GOLF BALL

The diagram shows the path of a golf ball from the time it leaves the golf club to when it hits the ground. The initial velocity of the golf ball is ***U* ms^{-1}.** It travels a horizontal distance (range) of ***R* metres** and a maximum height of ***H* metres.**

In this question ignore the air resistance acting on the golf ball.



(a) The path of the ball is a **projectile**. Explain what a **projectile path** means.

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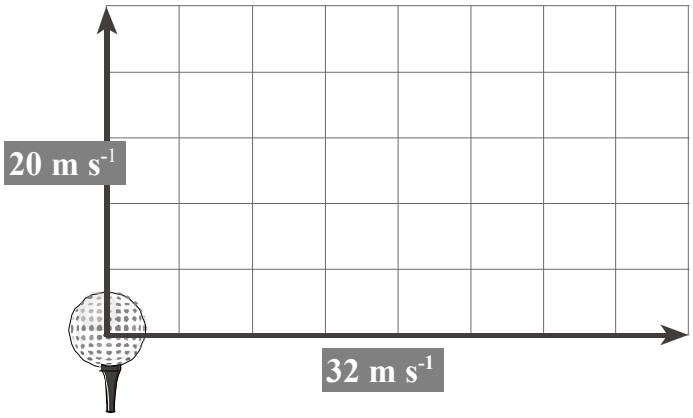
The diagram on the right shows the horizontal and vertical components of the **initial velocity** (***U***) of the golf ball.



(b) Draw clearly on the diagram a velocity vector to represent the **size** and **direction** of the initial velocity (***U***) of the golf ball.

Asses sor's use only

(c) Calculate the **size** and **direction** of the initial velocity ***U*** of the golf ball.

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_____

Size _____ Direction _____

(d) Explain the motion of the golf ball in *the vertical direction*. Give a reason for your explanation.

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_____

(e) Show that the time taken for the golf ball to reach the top of its flight is **2.0 seconds.** Acceleration due to gravity is 10 m s^{-2}.

_____

_____

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_____

(f) Calculate the maximum **vertical height** (***H***) reached by the golf ball at the top of its flight. Acceleration due to gravity is 10 m s^{-2}.

_____

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_____

_____

_____

Vertical height = _____

(g) Explain the motion of the golf ball in *the horizontal direction*, Give a reason for your explanation.

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(h) Calculate the **horizontal distance** (***R***) travelled by the golf ball.

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_____

Horizontal distance = _____