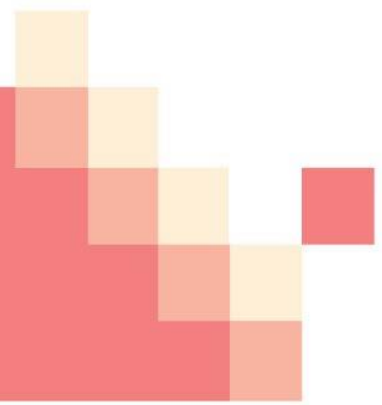




Year 12 Mathematics Extension 1  
Vectors  
**Projectile Motion**

**HOMEWORK**

**MATHEMATICS**



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2		2		
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5		6		
6	a	7		
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	c	9		
		10		
		11		
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<b>result</b>
<b>out of</b>



*Unless given otherwise, assume that  $g = 9.8\text{ms}^{-2}$*

**Question 1**

Suppose a projectile is launched at a speed of  $20\text{ms}^{-1}$  at an angle of  $30^\circ$  from the origin. Calculate the position and velocity vectors after 2 seconds.

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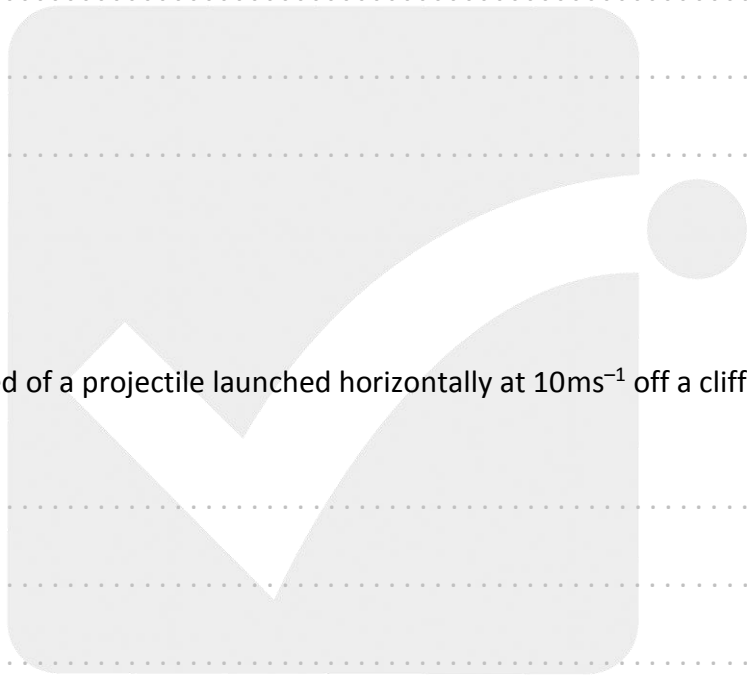
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**Question 2**

Find the impact speed of a projectile launched horizontally at  $10\text{ms}^{-1}$  off a cliff 80m tall.



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**Question 3**

What is the maximum height and range of a baseball thrown from 1m above the ground at a speed of  $30\text{ms}^{-1}$  and an angle of 10 degrees.

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**Question 4**

Evil Knievel (1938-2007) was an American stunt performer who would fly over canyons in a motorcycle by jumping between ramps placed on either side.

In one of these jumps, Evil Knievel crossed the Mississippi River, at a width of 60 metres.

- a) Supposing an optimal jump angle of  $45^\circ$ , how fast must Evil Knievel be travelling in order to make the jump?

- b) The Harley-Davidson VRSCR can accelerate from a standstill to 100km/h in 3.4 seconds. How many seconds of acceleration are required to reach the required speed? (Hint: convert to  $\text{ms}^{-1}$  first)

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**Question 5**

Suppose a particle can be launched at a speed of up to  $20\text{ms}^{-1}$ . What is the furthest the particle can be launched in a room with a ceiling five metres high? (Let  $g = 10$ ).

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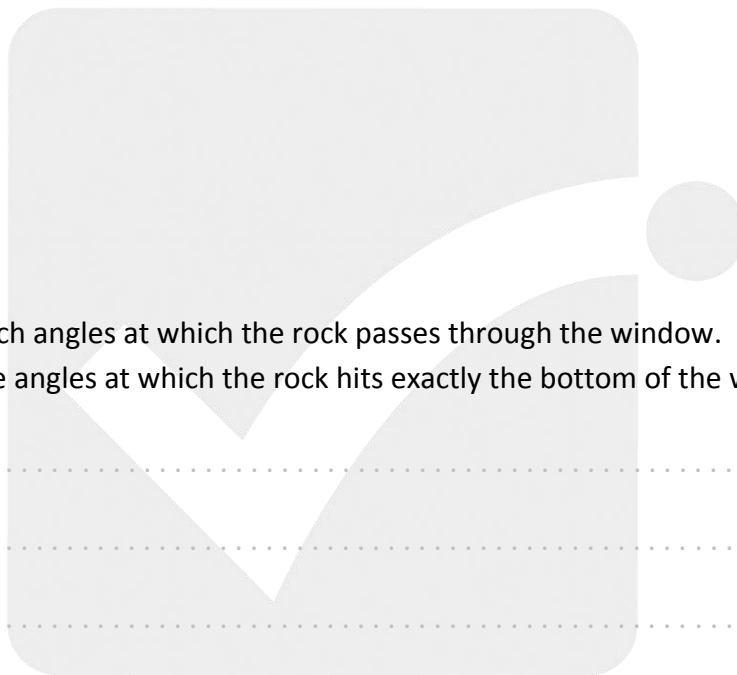
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**Question 6 (Extension)**

Consider a child throwing a rock through an open window. The window is 80cm tall and its base sits 2m above the ground. The child is standing 3m back from the window and throws the rock at a speed of  $8\text{ms}^{-1}$ .

- a) Draw a diagram showing the child, window, and a possible path for the rock through the window.



- b) Find the launch angles at which the rock passes through the window.  
(Hint, find the angles at which the rock hits exactly the bottom of the window)

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c) Inside the house, the floor sits 1m below the base of the window. At what points on the floor behind the window can be hit by the rock?

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