Test - Projectiles and variable acceleration

Year: Year 13 · Duration: 40 minutes · /20

Name:	Date:	**Mark: /20**

Question	1	2	3	4	5	Total
marks	4	4	4	4	4	**20**
Mark						

Show your working.

Question 1 (4 marks)

Question 1 – Thrown from a cliff

A ball is thrown horizontally at 15 m s^{-1} from the top of a cliff 40 m above the sea.

a. Find the time to reach the sea and the horizontal distance travelled. [2 marks]
b. Find the speed and direction when it enters the sea. [2 marks]

Question 2 (4 marks)

Question 2 – Range and time of flight

A ball is projected from level ground at 26 m s^{-1} at 35° above the horizontal.

a. Find the time of flight. [2 marks]
b. Find the range and the greatest height. [2 marks]

Question 3 (4 marks)

Question 3 – The equation of the path

A ball is projected from the origin at 20 m s^{-1} at 30° above the horizontal.

a. Show that the path is $y = x\tan 30^\circ - \dfrac{gx^2}{2\times 20^2\cos^2 30^\circ}$. [2 marks]
b. Find the height of the ball when $x = 25$ m. [2 marks]

Question 4 (4 marks)

Question 4 – Displacement and distance

A particle moves in a straight line with velocity $v = t^2 - 6t + 5$ m s^{-1} for $0 \le t \le 5$.

a. Find when the particle is at rest. [1 mark]
b. Find its displacement from $t = 0$ to $t = 5$. [1 mark]
c. Find the total distance it travels. [2 marks]

Question 5 (4 marks)

Question 5 – Motion with position vectors

A particle has position vector $\mathbf{r} = 2t^2\mathbf{i} + (t^3 - 3t)\mathbf{j}$ metres at time t seconds.

a. Find the velocity and acceleration vectors. [2 marks]
b. Find the speed and the magnitude of the acceleration when $t = 2$. [2 marks]