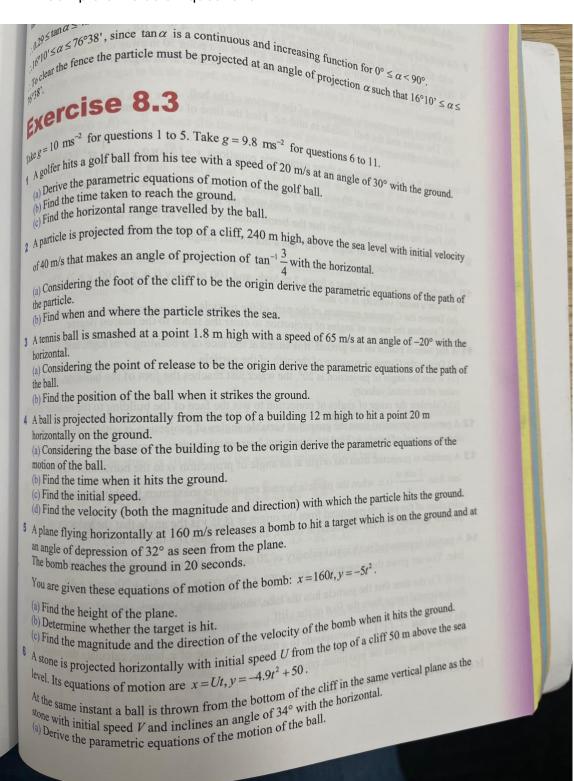
## Homework 16-02

## 2U - Curve-sketching

1. Complete the following questions from the Grind section of Curve Sketching: 3-9

## 3U - Projectile Motion

2. Complete the below questions.



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New Fundamental (b) If the stone and the ball collide in mid-air after 1.5 seconds, find their initial speeds and the ball collision. coordinates of the point of collision. (b) If the state coordinates of the point of collision. coordinates of the point of collision.

A stone is projected from the ground with initial speed of 20 m/s which makes an angle of 30.

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- A stone is projected from the with the ground. Its equations of motion are with the ground at a point 50 m away in the same ventical At the same instant a ball is thrown from the ground at a point 50 m away in the same ventical the same with the initial speed of 34 m/s but inclines at an angle of 162°53' with At the same instant a ball is thrown from the ground at a point away in the same ventical plane as the stone with the initial speed of 34 m/s but inclines at an angle of 162°53; with the (a) Derive the parametric equations of the motion of the ball.
  - (a) Derive the parametric equations of the Hierarchies (b) The stone and the ball collide in mid-air. Find the time of collision and the co-ordinates of the Hierarchies (b) The stone and the ball collide in mid-air.

point of collision.

In questions 8 to 13, you may use these parametric equations  $x = Ut \cos \alpha$ , y = -

8 A mortar bomb is fired at 50 m/s from the ground to hit a point on the ground 200 m away.

(a) Derive the Cartesian equation of the motion of the bomb.

- (b) Find the two possible angles that the bomb must be fired at to hit the target.
- A particle is thrown at an angle of 40° has a horizontal range of 100 m. Find the initial velocity.
- **10** A particle is projected to clear a fence 2 m high, and 100 m away (i.e.  $x = 100, y \ge 2$ ). The particle's initial velocity is 45 m/s.

(a) Derive the Cartesian equation of the path of the particle.

- (b) Calculate the range of angles of projection to clear the fence to the nearest degree.
- 11 A fire hose is placed on the ground. It is aimed at the face of a building 7 m high, and 40 m away, (a) Derive the Cartesian equation of the path of the particle.

(b) When the angle of projection is 20°, the water just reaches the foot of the building. Find the value of the initial velocity.

- (c) Calculate the range of angles of projection to wet the face of the building to the nearest degree.
- **12** A particle is projected from the ground at variable angles of projection  $\alpha$  with initial velocity Vinside a tunnel of height h. Find the maximum horizontal range.
- 13 A particle is projected from the origin at an angle of projection  $\alpha$  to the horizontal. After a time less than  $\frac{V \sin \alpha}{\alpha}$  (i.e. when the particle has not reached its maximum height), the angle of elevation of the particle measured from the origin is  $\beta$ . If  $\gamma$  is the angle that the velocity of the particle inclines with the horizontal at time t, show that  $2 \tan \beta = \tan \alpha + \tan \gamma$ .
- 14 A particle is projected with initial velocity of 20 m/s from the top of a cliff 40 m high above a lake. You are given these parametric equations  $x = 20t \cos \alpha$ ,  $y = -5t^2 + 20t \sin \alpha + 40$ .
  - (a) If T is the time that the particle hits the lake, show that  $x^2 = -25T^4 + 800T^2 1600$ , where x is the horizontal range from the foot of the cliff.
  - (b) Show that  $\frac{d}{dT}(x^2) = 0$  corresponds to a maximum value of x, hence, calculate the angle of projection that gives the maximum range.

In questions 15 to 18, you may use this Cartesian equation  $y = -\frac{gx^2}{2U^2}\sec^2\alpha + x\tan\alpha$ .