

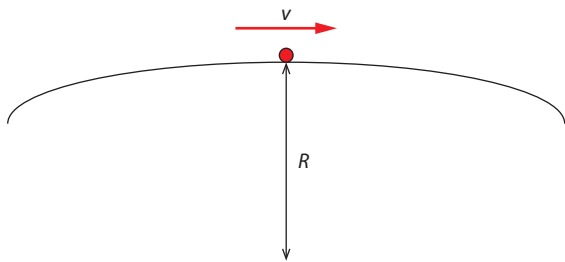
Self-test questions

Topic 6

- 1 Two objects X and Y are placed on a horizontal disc of radius R that rotates about a vertical axis through its centre at constant speed. Particle X is placed at a distance $\frac{R}{2}$ from the centre of the disc. Particle Y is placed at the rim of the disc. The linear speed of X is v and its centripetal acceleration is a . Which is the linear speed and centripetal acceleration of Y?

	speed	acceleration
A	v	a
B	v	$2a$
C	$2v$	a
D	$2v$	$2a$

- 2 A car moves along a path that is part of a vertical circle of radius R . The speed of the car at the highest point is v .

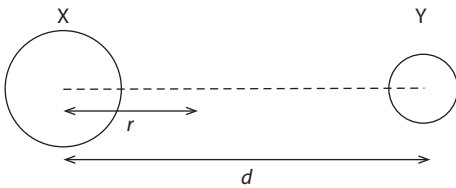


What is the maximum value of v so that the car does not lose contact with the road?

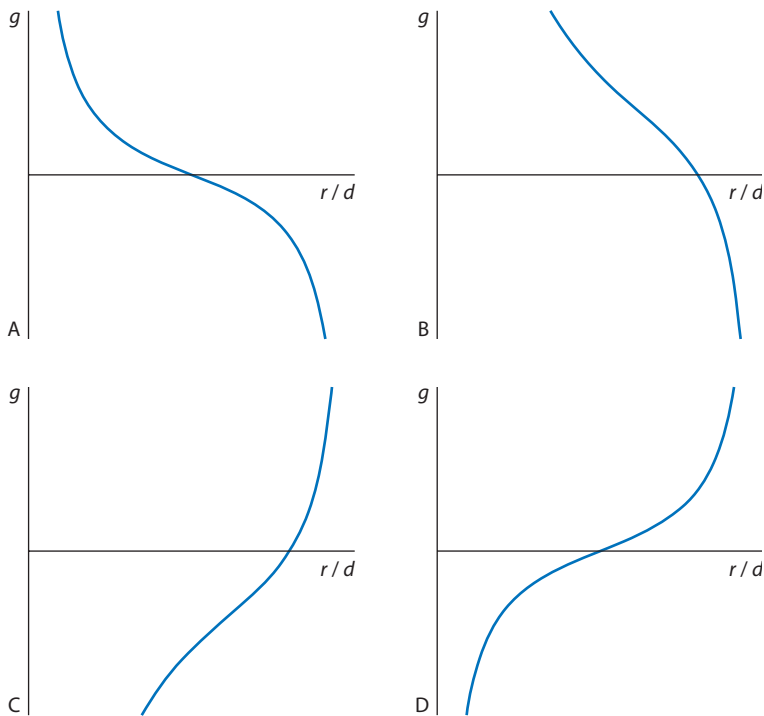
- A $\frac{\sqrt{gR}}{2}$
B \sqrt{gR}
C $\sqrt{2gR}$
D $2\sqrt{gR}$
- 3 A particle moves along a horizontal circle with constant speed. Which of the following is correct about the magnitude and direction of the acceleration?

	Magnitude	Direction
A	constant	changing
B	constant	constant
C	changing	changing
D	changing	constant

- 4 A probe orbits a planet in a circular orbit of radius r . It completes one revolution in T seconds. What is the mass of the planet?
- A $\frac{4\pi^2 r^3}{GT^2}$
- B $\frac{4\pi^2 r}{GT^2}$
- C $\frac{4G\pi^2 r^3}{T^2}$
- D $\frac{4G\pi^2 r}{T^2}$
- 5 Two stars are separated by a distance d . The mass of star X is 4 times the mass of star Y.



The net gravitational field strength along the dotted line a distance r from the centre of star X is g . Positive g means the field is directed to the right. Which graph shows the variation of g with r/d ?



- A
- B
- C
- D
- 6 A planet has three times the mass and three times the radius of Earth. The gravitational field strength at the surface of Earth is g . What is the gravitational field strength at the surface of the planet?
- A g
- B $\frac{g}{3}$
- C $\frac{g}{9}$
- D $\frac{g}{27}$

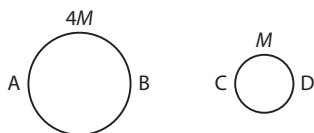
7 Two identical satellites, X and Y, orbit the Earth in circular orbits. The radius of the orbit of satellite Y is double that of satellite X. What is the ratio $\frac{v_X}{v_Y}$ of the orbital speeds of the two satellites?

- A $\frac{1}{2}$
- B 2
- C $\frac{1}{\sqrt{2}}$
- D $\sqrt{2}$

8 Which of the following is correct about a probe that orbits the Earth in a circular orbit at constant speed?

- A the acceleration is constant
- B the velocity is constant
- C the kinetic energy is constant
- D the momentum is constant

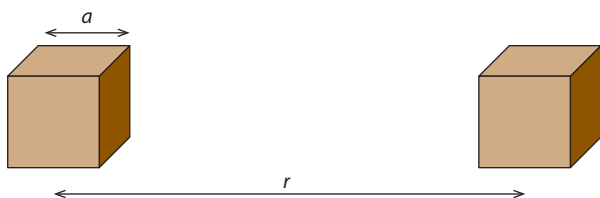
9 Two stars have masses $4M$ and M .



At which point is the magnitude of the combined gravitational field strength the least?

- A
- B
- C
- D

10 A student attempts to use the formula $F = \frac{Gm^2}{r^2}$ to calculate the gravitational force between two uniform cubes of side a and mass m .



The result will be:

- A correct
- B approximately correct
- C approximately correct only if $a = r$
- D approximately correct only if $a \ll r$