# **11 Physics Revision**

## Motion

#### Vector Manipulation

1. A cyclist enters a roundabout at 32 km/h 070° and exits the roundabout at 27 km/h 160°. Find the cyclist’s change in velocity.
2. A pool ball travelling at 3.92 m s-1 strikes the edge of the table and bounces straight up in the air at 3.46 m s-1. Determine the ball’s change in velocity.
3. A bullet travelling at 472 m s-1 ricochets off tank armour at 341 m s-1. Determine the bullet’s change in velocity if the angle of incidence and angle of reflection were both 45°.
4. A boat needs to directly cross to the East side of a river, perpendicular to the current. If the current flows at 2.8 m s-1 S, and the barge’s engines can push it at 6.4 m s-1, what direction must it steer in?

#### Complex Problems

1. A cyclist enters a roundabout at 27 km/h 250° and exits the roundabout at 19 km/h 160°. Find the force exerted on the cyclist if the cornering took 12 s and combined mass of the cyclist and bicycle is 107 kg.
2. A 166 g pool ball travelling at 3.84 m s-1 strikes the edge of the table and bounces straight up in the air at 3.12 m s-1. Find the force exerted on the ball if it was contacting the table edge for 0.14 s.
3. A 26 g bullet travelling at 390 m s-1 ricochets off tank armour at 270 m s-1. Determine the force the bullet exerted on the tank if the angle of incidence and angle of reflection were both 45° and the collision took 0.07 s.
4. A boat needs to directly cross to the East side of a 120 m river, perpendicular to the current. If the current flows at 3.1 m s-1 S, and the barge’s engines can push it at 7.9 m s-1, how long will it take to cross?

# 11 Physics Revision Solutions

## Motion Solutions

#### Vector Manipulation Solutions

1.

v=27 km/h

-u=32 km/h

Δv

θ

v=27 km/h

u=32 km/h

$$∆v=\sqrt{27^{2}+32^{2}}=41.9 km/h$$

$$θ=tan^{-1}\left(\frac{27}{32}\right)=40.16°$$

$$TB=70+180-40.16=210°$$

$$∆v=41.9 km/h 210°$$

1.

v=3.46 m s-1

-u=3.92 m s-1

Δv

θ

v=3.46 m s-1

u=3.92 m s-1

$$∆v=\sqrt{3.46^{2}+3.92^{2}}=5.23 m s^{-1}$$

$$θ=tan^{-1}\left(\frac{3.46}{3.92}\right)=41.43°$$

$$∆v=5.23 m s^{-1} back from the edge, 41.4° up from horizontal$$

1.

v=341 m s-1

-u=472 m s-1

Δv

θ

v=341 m s-1

u=472 m s-1

$$∆v=\sqrt{472^{2}+341^{2}}=582 m s^{-1}$$

$$θ=tan^{-1}\left(\frac{341}{472}\right)=35.85°$$

$$45+35.85=80.8°$$

$$∆v=582 m s^{-1} 80.8° from the surface$$

R

v2=2.8 m s-1

v1=6.4 m s-1

θ

 $θ=sin^{-1}\left(\frac{2.8}{6.4}\right)=25.9°=026° $

#### Complex Problem Solutions

1.

v=19 km/h

u=27 km/h

v=19 km/h

-u=27 km/h

Δv

θ

$$∆v=\sqrt{27^{2}+19^{2}}=33.0 km/h$$

$$θ=tan^{-1}\left(\frac{19}{27}\right)=35.13°$$

$$TB=250-180+35.13=105°$$

$$a=\frac{∆v}{t}=\frac{(33.0÷3.6)}{12}=0.764 m s^{-2} 105°$$

$$F=ma=107×0.764=81.8 N 105°$$

1.

v=3.12 m s-1

-u=3.84 m s-1

Δv

θ

v=3.12 m s-1

u=3.84 m s-1

$$∆v=\sqrt{3.12^{2}+3.84^{2}}=4.95 m s^{-1}$$

$$θ=tan^{-1}\left(\frac{3.12}{3.84}\right)=39.09°$$

$$a=\frac{∆v}{t}=\frac{4.95}{0.14}=35.34 m s^{-2} 39.1°$$

$$F=ma=0.166×35.34=5.87 N back from the edge, 39.1° up from horizontal$$

1.

v=270 m s-1

u=390 m s-1

v=270 m s-1

-u=390 m s-1

Δv

θ

$$∆v=\sqrt{390^{2}+270^{2}}=474 m s^{-1}$$

$$θ=tan^{-1}\left(\frac{270}{390}\right)=34.7°$$

$$45+34.7=79.7°$$

$$a=\frac{∆v}{t}=\frac{474}{0.07}=6780 m s^{-2} 79.7°$$

$$F=ma=0.026×6780=176 N 79.7° from the surface$$

R

v2=3.1 m s-1

v1=7.9 m s-1

θ

 $R=\sqrt{\left(7.9^{2}-3.1^{2}\right)}=7.27 m s^{-1}$

$$t=\frac{s}{v}=\frac{120}{7.27}=16.5 s$$