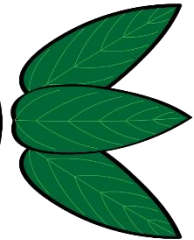ASPIRE
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Year 7

Term 3, Week 6 (Unit 3)

Name: ……………………………………………………….

Class: ………………………………………………………

Exercise 3.1B Unbalanced forces

Practice skills

In this exercise, you will be thinking about the effects of unbalanced forces.

1 Which of these can happen because of unbalanced forces?

Tick (✓) **all** correct statements.

A car will move at a constant speed.   ☐

A boat will slow down.   ☐

A football will change direction.   ☐

A book will not move on a desk.   ☐

2 The diagram shows the forces on a car.
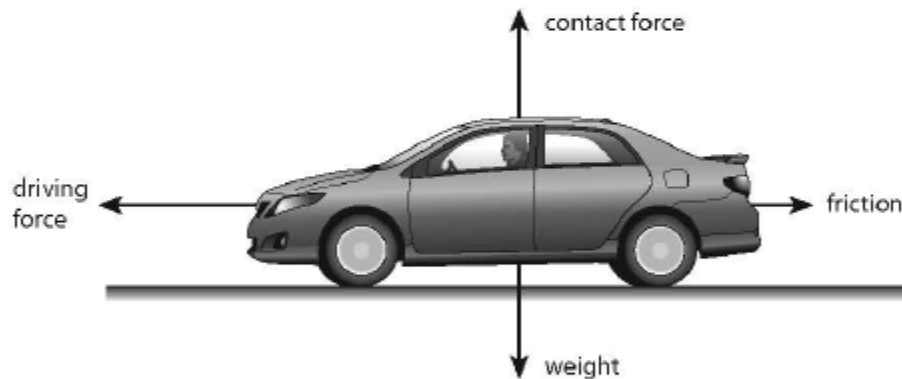
State:

a which forces are balanced

.... and ....

b which forces are unbalanced

.... and ....

c what will happen to the car.

....

Exercise 3.1C Changing direction

Challenge

In this exercise, you will describe how unbalanced forces can cause a change in direction of movement.

1   The diagram shows the forces, A–D, acting on a bird when it is flying.

a   Describe the effect of these forces on the movement of the bird.

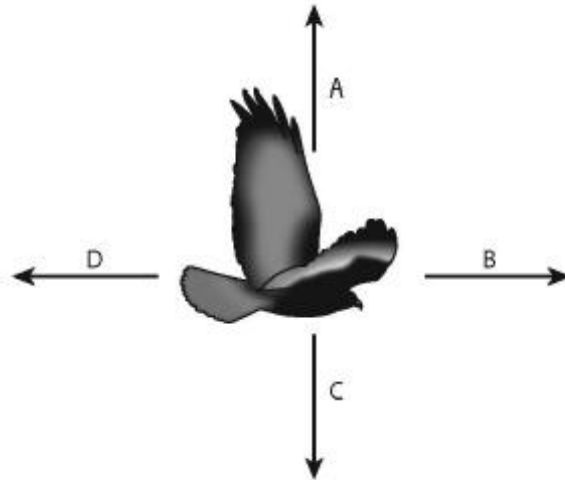...

....

....

b   Describe **one** change needed to the forces for the bird to go higher.

....

c   Describe **two** changes to the forces that would make the bird go slower.

1   ....

2   ....

2 An aeroplane is flying north, in a straight line, at a constant speed.

The aeroplane needs to turn towards east.

Draw an arrow on the diagram to show the direction of the unbalanced force needed to make the aeroplane turn east.

North

West ←———————→ East

South
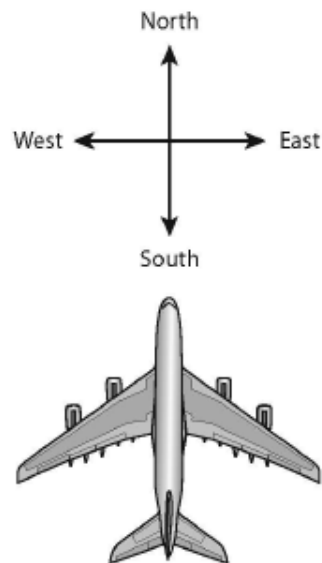
3 Tetherball is a game. A tennis ball is attached to a string. The string can rotate around a vertical pole. The tennis ball moves in a circle around the pole.

direction of tennis ball

tennis ball

pole

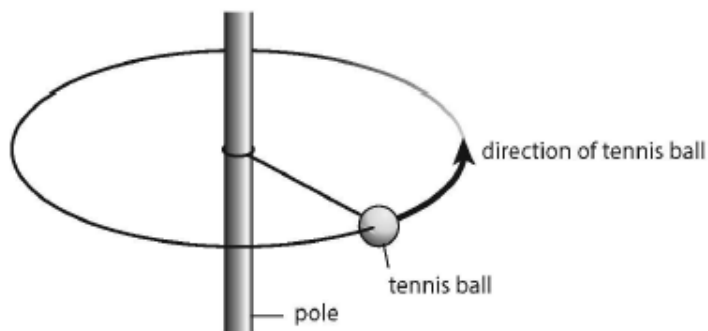The tennis ball in the diagram has been hit by a player and is moving in the direction shown.

a Draw an arrow on the diagram to show the direction of the force on the tennis ball. Label this arrow F.

The string breaks when the tennis ball is at the position shown in the diagram.

b Draw another arrow on the diagram to show the direction that the tennis ball will move when the string breaks. Label this arrow D.

› 3.2 Working out speed

Exercise 3.2A Units of speed

Focus

In this exercise, you will consider the units of speed.

1   a   Which of these is the standard unit of distance in science?
        Circle **one** unit.

        metre   foot   mile   kilometre

    b   Which of these is the standard unit of time in science?
        Circle **one** unit.

        day   hour   minute   second

    c   Which of these is the standard unit for speed in science?
        Circle **one** unit.

        m s   m/s   m/s²   m²s

2   Speed can be measured in kilometres per hour, km/h.
    A motorcycle travels at 60 km/h.
    What does 60 km/h mean?
    Tick (✓) **one** box.
    It travels a distance of 60 m every second.   ☐
    It travels a distance of 60 m every hour.   ☐
    It travels a distance of 60 km every second.   ☐
    It travels a distance of 60 km every hour.   ☐

3   In the year 2016, a spacecraft reached a speed of 260 000 km/h.
Calculate the distance this spacecraft would travel in 2 hours.
Show your working.

.... km

Exercise 3.2B Calculating speed

Practice

In this exercise, you will calculate the speeds of some objects.

1   **a**   Write the equation that links speed, distance and time.

b   Give the unit of speed when distance is in metres and time is
in seconds.

....

In each of these calculations, show your working **and** give the unit with
your answer.

2   A car travels a distance of 70 m in a time of 2 s.

a   Calculate the average speed of the car.

....

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The car changes speed to travel a distance of 30 m in a time of 2 s.

b Calculate the new speed of the car.

....

3 Arun walks from home to school. School is a distance of 450 m from Arun's home.

Arun walks this distance in a time of 300 s.

a Calculate Arun's average walking speed.

....

b Explain why your answer to part **a** is an average speed.

....

....

4 An aeroplane travels a distance of 5400 km in a time of 6 hours.

Calculate the average speed of the aeroplane, in km/h.

....

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Exercise 3.2C Calculating distance and time

Challenge

In this exercise, you will use speed to calculate either the distance or the time of travel.

1 **a** Complete the equation for calculating distance from speed and time.

$$\text{distance} =$$

b Complete the equation for calculating time of travel from speed and distance.

$$\text{time} =$$

In each of these calculations, show your working **and** give the unit with your answer.

2 A train travels at a constant speed of 45 m/s.

  a Calculate the distance travelled by the train in:

  i 30 s

  ....

  ii 2 minutes.

  ....

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3   Zara runs at a constant speed of 4 m/s.

Sofia rides her bicycle at a constant speed of 6 m/s.

a   Calculate the time taken for Zara to run a distance of 120 m.

....

b   Calculate how much further Sofia travels in one minute than Zara does.

....

4   Marcus's father plans to travel by car. He needs to travel a distance of 50 km in a time of 2 hours.

a   Calculate the average speed at which the car must travel.

....

b   Explain why the car must go faster than your answer to part **a** for some parts of the journey.

....

....

....

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› 3.3 Describing movement

Exercise 3.3A Distance–time graphs 1

Focus

In this exercise, you will decide what you can work out from a distance–time graph.

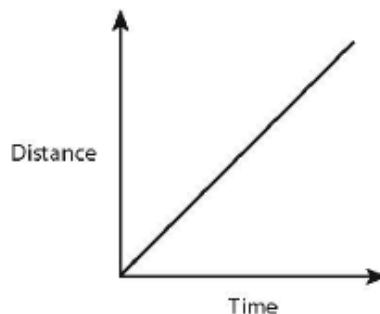1   Which of these can be worked out from a distance–time graph?

Tick (✓) **one** box.

the force on an object ☐
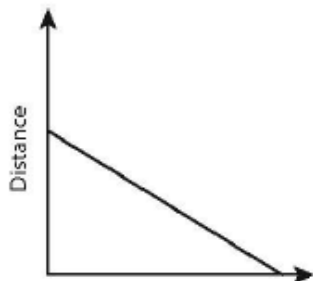the speed of an object ☐
the mass of an object ☐
the weight of an object ☐

2   Look at the distance–time graph for a train.

a   Which of these distance–time graphs shows the train going faster?

Write the letter. ....
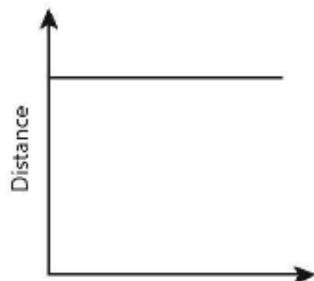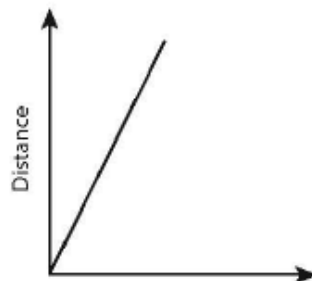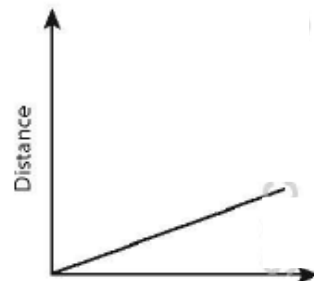
b   Which distance–time graph in part **a** shows no change in distance with time?

Write the letter. ....

Exercise 3.3B Distance–time graphs 2

Practice

In this exercise, you will sketch some distance–time graphs.

When sketching a graph, you only label the axes with quantities. You do **not** need to scale the axes **or** put numbers on the axes.

1   Sketch a distance time graph for:

  a   a stationary object

  b   an object travelling at a constant speed away from a starting position

  c   an object travelling at a constant speed towards a starting position.

Exercise 3.3C Distance–time graphs 3

Challenge

In this exercise, you will draw a distance–time graph and work out values from the graph.

1   An aeroplane departs from airport A at time 0 hours.

The aeroplane takes 4.5 hours to travel to airport B.

Airport B is a distance of 3600 km away from airport A.

The aeroplane spends 1.5 hours at airport B, before departing again for airport A.

The journey back from airport B to airport A takes 4.0 hours.

a   Draw a distance–time graph of the journey on the grid below.
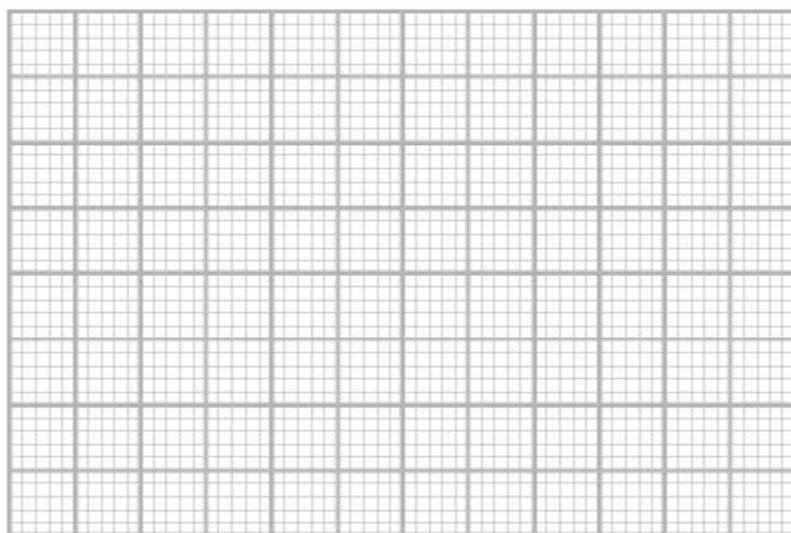
Use your graph to work out:

i   the total time of the journey

    ....

ii   the speed of the aeroplane going from airport A to airport B

    ....

iii   the speed of the aeroplane going from airport B to airport A.

    ....

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Exercise 3.4B Calculating moments

Practice

In this exercise, you will calculate moments and make predictions about moments.

1   Write the equation that links moment, force and distance.

2   The picture shows a crane supporting a 15 000 N weight.

The weight is supported 5 m from the pivot of the crane.
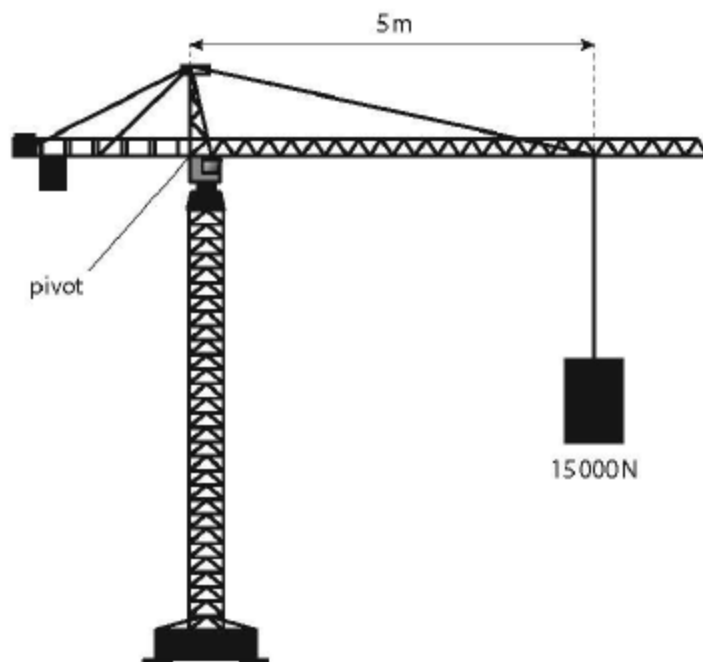
a   Calculate the moment caused by the weight on the crane.

Show your working.

.....................................Nm

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b Explain the effect on this moment of:

i moving the weight further from the pivot

....

....

ii moving the weight closer to the pivot.

....

....

3 Some people use units that are **not** international standard units.

One of these units of distance is the foot.

One of these units of force is pounds.

Write the unit of moment in these units.

....

Exercise 3.4C Moments, force and distance

Challenge

In this exercise, you will calculate forces and distances for moments.

1 A spanner will turn a nut. The nut needs a moment of 40 Nm to turn. The spanner is 0.2 m long.
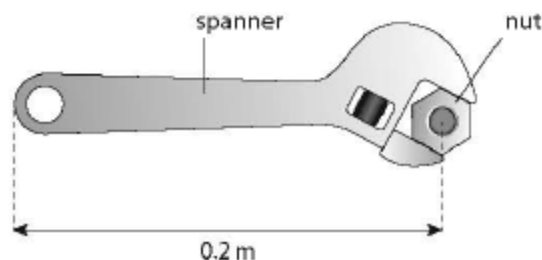
a Calculate the force that must be exerted on the spanner.

Show your working and give the unit.

....

b Explain why using a longer spanner will make the nut easier to turn.

....

....

2 An engine exerts a moment of 350 Nm when measured at a wheel.
The engine drives a wheel that has a radius of 0.35 m The pivot of the wheel is at the centre.

0.35 m

Calculate the force at the outside of the wheel.

Show your working and give the unit.

....

3 Sofia weighs 500 N. She sits on a seesaw at a distance of 2 m from the pivot.

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a   Calculate the moment that Sofia exerts on the seesaw.
Show your working and give the unit.

....

The seesaw will balance when the moments on both sides are equal.
Zara weighs 400 N.

b   Calculate the distance from the pivot to where Zara should sit to
balance the seesaw.
Show your working and give the unit.

....

› 3.5 Pressure between solids

Exercise 3.5A Describing pressure

Focus

In this exercise, you will describe what affects pressure in solids.

1   Which of these is used to work out pressure?
Tick (✓) **one** box.

$\text{pressure} = \dfrac{\text{force}}{\text{area}}$ ☐ $\text{pressure} = \text{mass} \times \text{area}$ ☐

$\text{pressure} = \dfrac{\text{mass}}{\text{area}}$ ☐ $\text{pressure} = \text{force} \times \text{area}$ ☐

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2   Zara has four different styles of shoes.

Which shoes will exert the greatest pressure on the floor when Zara wears them?

Tick (✓) **one** box.

☐   ☐   ☐   ☐
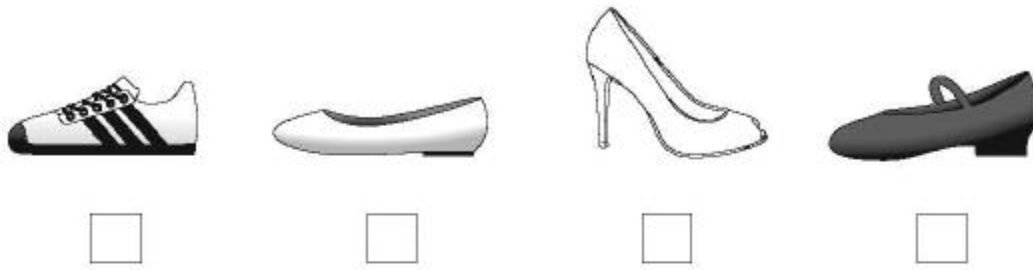
3   The picture shows a box. The areas of three faces of the box, A, B and C are shown.

A = 40 cm²

B = 15 cm²

C = 60 cm²
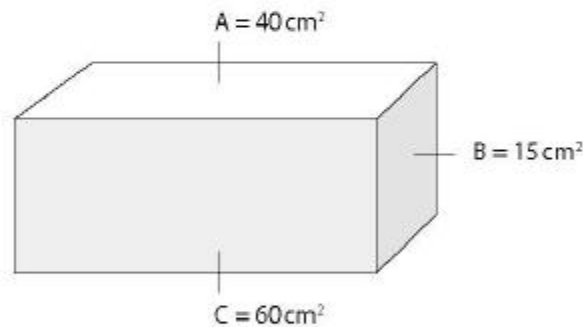
a   Which face of the box will exert the **smallest** pressure on the floor?

Write the letter. ....

b   Explain your answer to part **a**.

....

....

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Practice

In this exercise, you will calculate pressure in solids and think about the units of pressure.

1 A rock exerts a pressure of $20\,N/cm^2$ on the ground.

What does $20\,N/cm^2$ mean?

Complete the sentence.

A force of .... acts on each .... of area.

2 A large book has a weight of $15\,N$. The area of one end of the book is $60\,cm^2$.

Calculate the pressure the book exerts when standing on this end.

Show your working.

.... N/cm^2

3 A nail will go into wood if the pressure on the end of the nail is $60\,N/mm^2$.

The area of the end of the nail in contact with the wood is $0.5\,mm^2$.

Calculate the force needed on the nail to make it go into the wood.

Show your working and give the unit with your answer.

....

4 Not all of the units used by people are standard scientific units. Some people use other units.

One of these other units of force is pounds.

One of these other units of area is square inch.

State the unit of pressure in these other units.

....

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Exercise 3.5C
Variables affecting pressure

Challenge

In this exercise, you will consider the variables that affect pressure in solids.

1   The picture shows part of the stem of a plant called a rose.
    The stem has parts called thorns.
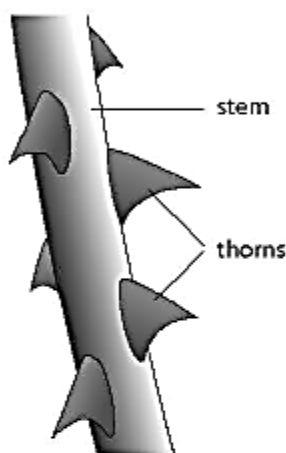
Explain why touching the thorns is more dangerous than touching other parts of the stem.

....

....

....

2   Cars can get stuck in sand when a wheel sinks down into the sand.

Explain why putting a large piece of wood under the wheel can stop the wheel from sinking.

....

....

....

3   Arun is cutting bread.

Explain why a sharp knife is better for cutting bread than a knife that is **not** sharp.

....

....

....

4   The picture shows a drawing pin. The two ends of the drawing pin are labelled A and B.

A   B

Part A is pushed by your thumb.

Part B goes into a wall or drawing board.

Explain the shape of each end of the drawing pin.

....

....

....

....