



Pearson BTEC Level 2 Diploma in Aerospace and Aviation Engineering (Foundation Knowledge)

First teaching September 2015

Sample Assessment Materials— Mathematics for Engineering

Unit 4: Mathematics and Science for Engineering

Version 1.0

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Sample Assessment Materials—Mathematics for Engineering

Unit 4: Mathematics and Science for Engineering



Information for candidates

INSTRUCTIONS

- Read each question carefully before you start to answer it.
- Answer all questions
- A paper Formulae sheet is provided. You can also access the Formulae sheet on every screen by selecting the Formulae button in the top right corner of the test.
- You can use rough paper to make notes and calculations. This will not be marked but must be handed in at the end of the test.

INFORMATION

- Time allowed 70 minutes.
- There are 47 questions in this test.
- The total number of marks is 60.
- The marks for each question are shown in brackets e.g. (2).
- An accessibility panel is available on every screen. This allows you to magnify your screen and apply a range of colour filters.
- You may use a non-programable calculator.



ADVICE

- Check your answers if you have time at the end.

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Start Test



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⌚ 01:10

Finish

Mathematics for Engineering

Formulae Sheet

Equations of linear motion with uniform acceleration

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

$$s = \frac{1}{2}(u + v)t$$

Work, Power and Forces

Force = mass x acceleration ($F=ma$)

Work Done = Force x distance moved ($W=Fd$)

Power = $\frac{\text{Work Done}}{\text{time}}$ ($P=\frac{W}{t}$)

Physical constant

Acceleration due to gravity = $g = 10 \text{ m/s}^2$

Energy relationships

Gravitational Potential Energy = mass x g x height ($GPE=mgh$)

Energy transferred = Work Done

Kinetic Energy = $\frac{1}{2}mv^2$

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⌚ 01:10

Finish



Calculate $36\,500 + 4\,000$

(1)

Select **one** option.

32 500

36 900

40 500

76 500



Put the temperatures in order of size.

(1)

Drag and drop the temperatures into the correct order.

The lowest temperature should be placed at the bottom of the drop zone area.

Temperatures

0°C

-42°C

18°C

high

57°C

48°C

low



Calculate 240×50

(1)

Select **one** option.

290

1200

10 200

12 000



Round 43.718 to 1 decimal place.

(1)

Type your answer in the box.



Here is a calculation

$$4 + 8 \times 6 - 3$$

Identify the part of the calculation that should be done **first**.

(1)

Select **one** option.

$4 + 8$

8×6

$6 - 3$

12×6



Calculate 2×3^2

(1)

Type your answer in the box.



Calculate $\frac{3}{10}$ of 800 litres.

(1)

Select **one** option.

24 litres

240 litres

2400 litres

24 000 litres



Express the ratio 80:120 in its simplest form.

(1)

Type your answer in the boxes.

 :



Calculate 16 as a percentage of 200

(1)

Select **one** option.

8%

16%

32%

80%



1 m³ of steel has a mass of 8000 g

Calculate the mass of 2.5 m³ of steel.

(1)

Select **one** option.

2000 g

3200 g

20 000 g

32 000 g



Calculate 10 % of £700

(1)

Type your answer in the box.

£

Given $y = \frac{1}{x^2}$

Calculate the value of y when $x = 2$

(1)

Select **one** option.

 4 1 $\frac{1}{2}$ $\frac{1}{4}$



Increase £300 by 20 %

(1)

Type your answer in the box.

£



The price of an item increases from £120 to £144

Express the price increase as a percentage of the original price.

(1)

Select **one** option.

10 %

17 %

20 %

24 %



A 20 m length of pipe is divided in the ratio 2 : 3

Calculate the length of the shorter piece of pipe.

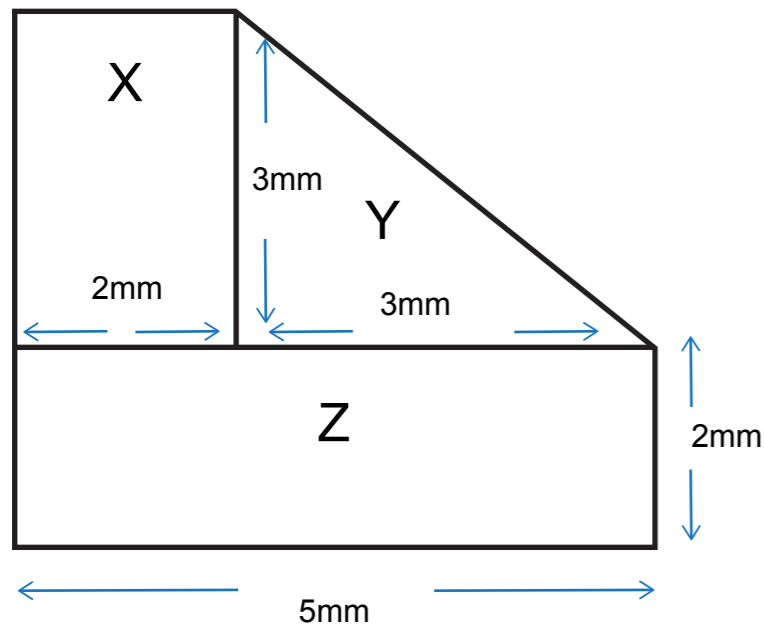
(1)

Type your answer in the box.

 m



A compound shape has the following measurements.



(a) Calculate the area of triangle Y (1)

Select **one** option.

4.5 mm²

6 mm²

9 mm²

10.5 mm²

(b) Identify the calculation that should be used to find the area of rectangle Z (1)

Select **one** option.

$2 + 5 + 2 + 5$

$\frac{1}{2} \times 2 \times 5$

2×5

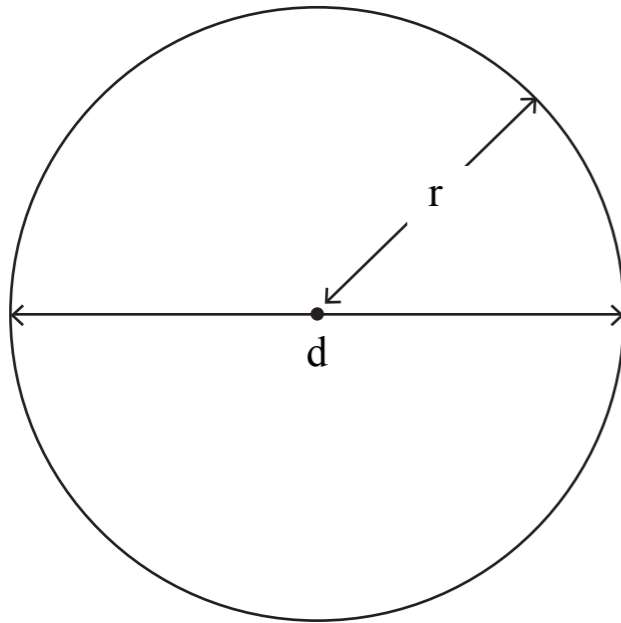
$\frac{1}{2} \times 2 + 5$



Identify the formula for the area of a circle, diameter d and radius r

(1)

Select **one** option.



$A = \pi d$

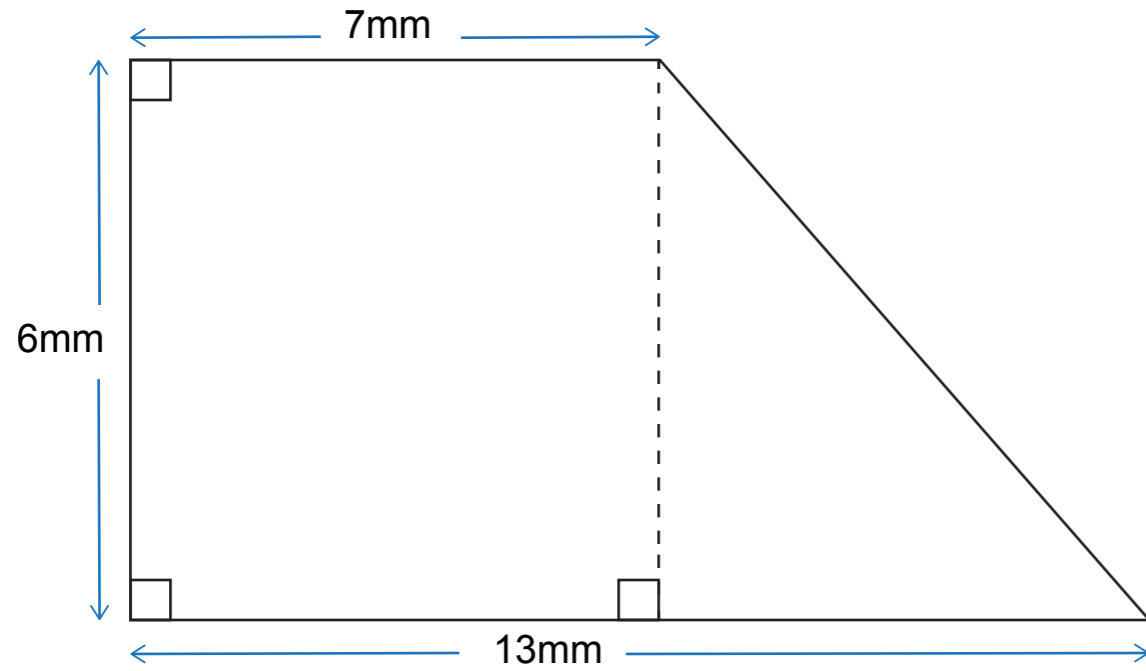
$A = \pi d^2$

$A = 2\pi r$

$A = \pi r^2$



The diagram shows a shape.



Calculate the total area of the shape.

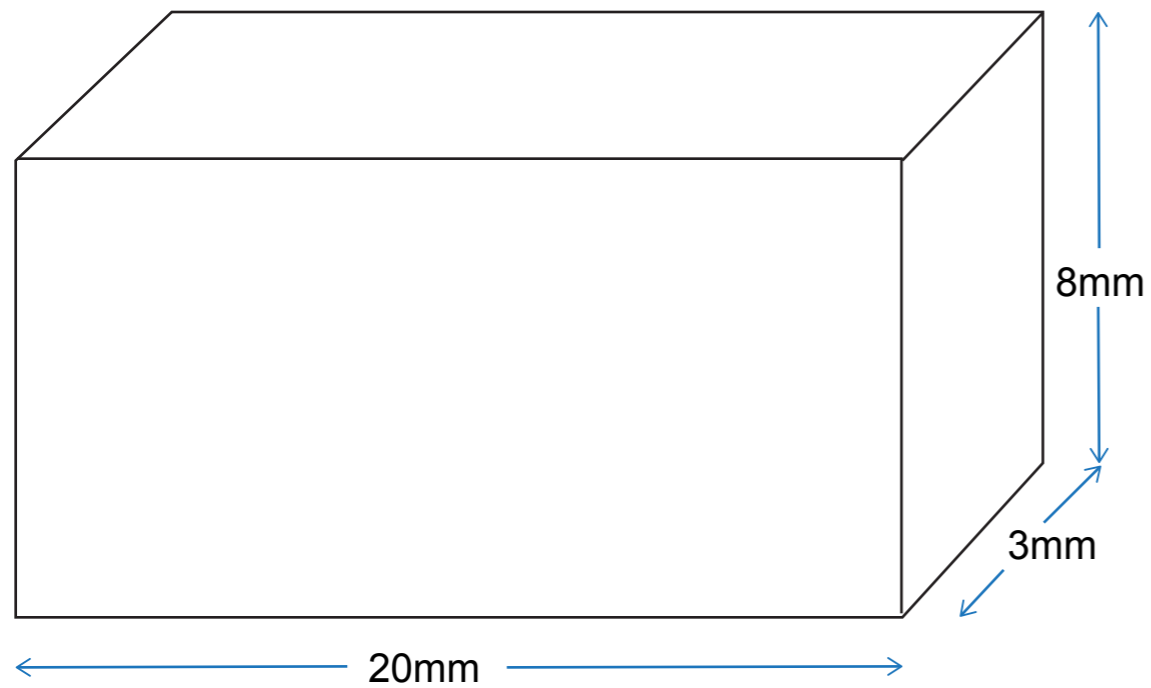
(1)

Type your answer in the box.

 mm²



The diagram shows a cuboid.



Calculate the volume of this cuboid.

(1)

Select **one** option.

31 mm³

62 mm³

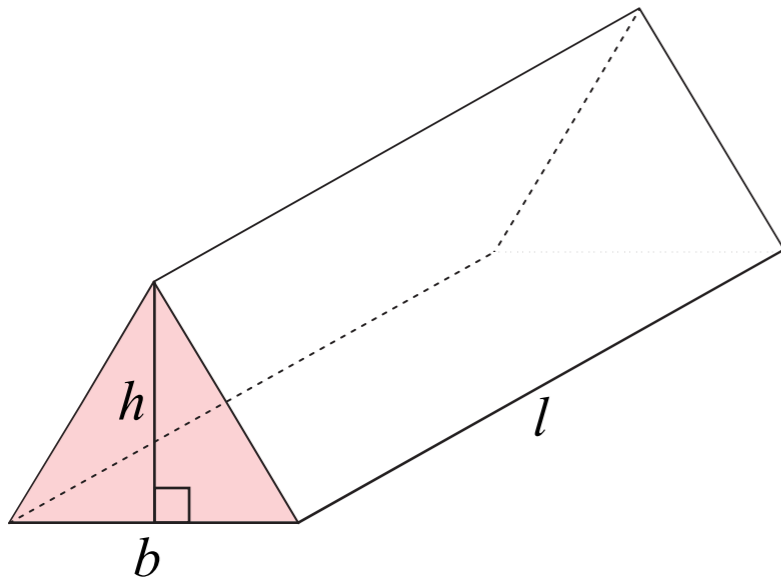
240 mm³

480 mm³



Identify the formula that should be used to calculate the volume of the prism. (1)

Select **one** option.



$V = \frac{1}{2}bhl$

$V = bhl$

$V = bh^2l$

$V = 2\pi hb^2l$

Calculate the value of 2^3

(1)

Select **one** option.

 4 6 8 9



Calculate the positive value of $\sqrt{36}$

(1)

Select **one** option.

 2 6 18 1296



Calculate $\sqrt[3]{27}$

(1)

Select **one** option.

$\frac{1}{9}$

3

9

81



Simplify $8x + 3y - 5x + 4y$

(1)

Select **one** option.

$3x + 7y$

$13x + 7y$

$3x - y$

$13x - 7y$



Factorise $6a + 8$

(1)

Select **one** option.

$6(a + 8)$

$2(3a + 8)$

$3(2a + 4)$

$2(3a + 4)$



Make a the subject of the formula $v = u + at$

(1)

Select **one** option.

$a = \frac{v}{t} - u$

$a = \frac{v-u}{t}$

$a = \frac{v+u}{t}$

$a = \frac{u-v}{t}$



Calculate the value of $2t^2 + 3$ when $t=3$

(1)

Select **one** option.

14

21

26

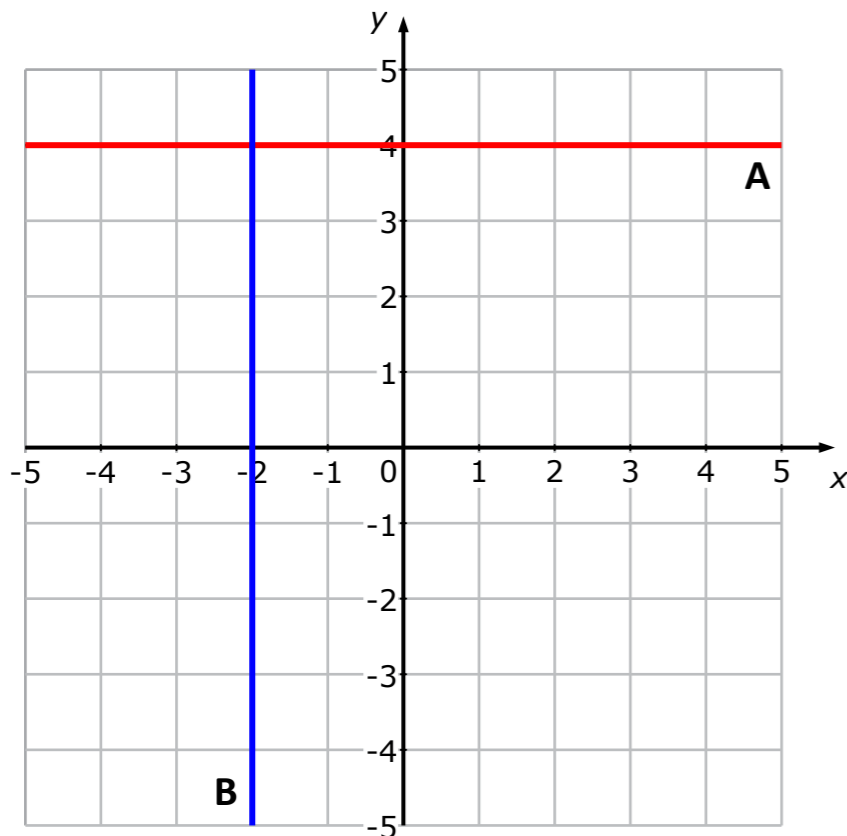
39

The diagram shows 2 straight line graphs.

Find the equation of each line.

(2)

Click on each line label and then select the correct equation.



Line label

Equation

line A

$y = -2$

$x = -2$

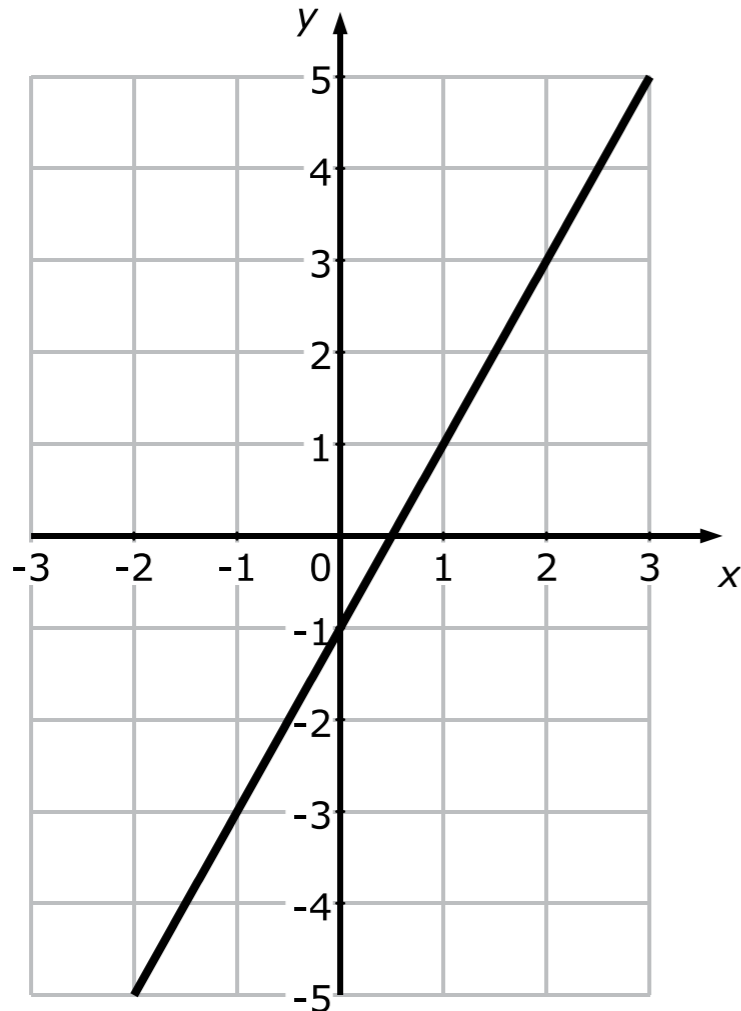
$y = 4$

line B

$x = 4$

$y = 2x$

The diagram shows the graph of a straight line.



(a) Find the gradient of the line. (1)

Select **one** option.

2

$\frac{1}{2}$

$-\frac{1}{2}$

-2

(b) Find the coordinates of the y axis intercept. (1)

Select **one** option.

(-1, 0)

(0, -1)

$(0, \frac{1}{2})$

$(\frac{1}{2}, 0)$

The equation of a straight line is $y = 4x + 3$

Find the gradient of this straight line.

(1)

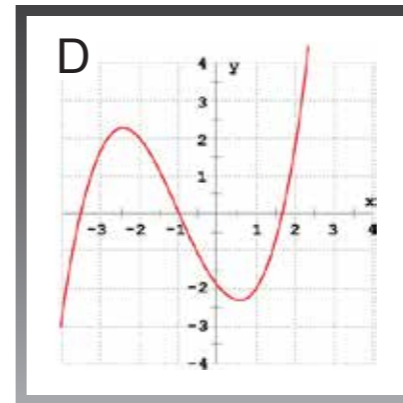
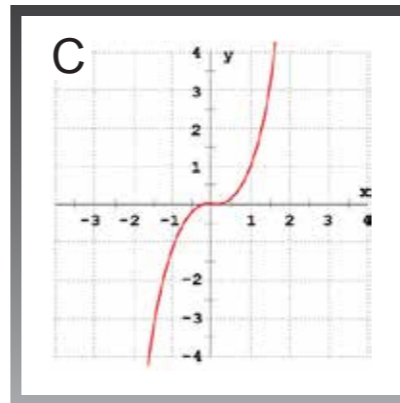
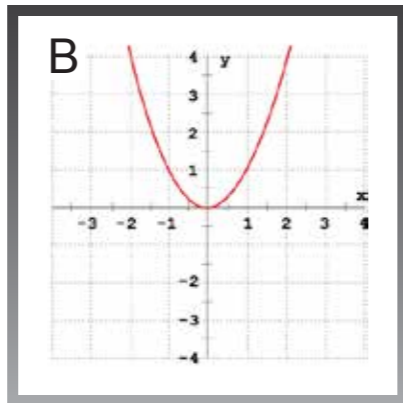
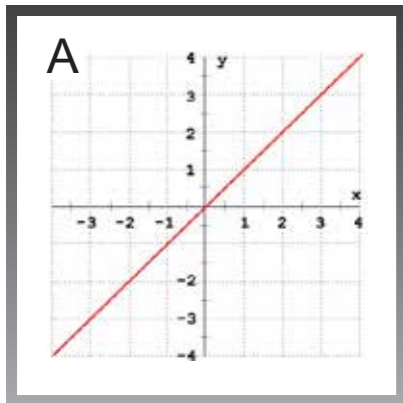
Select **one** option.

 -4 -3 3 4

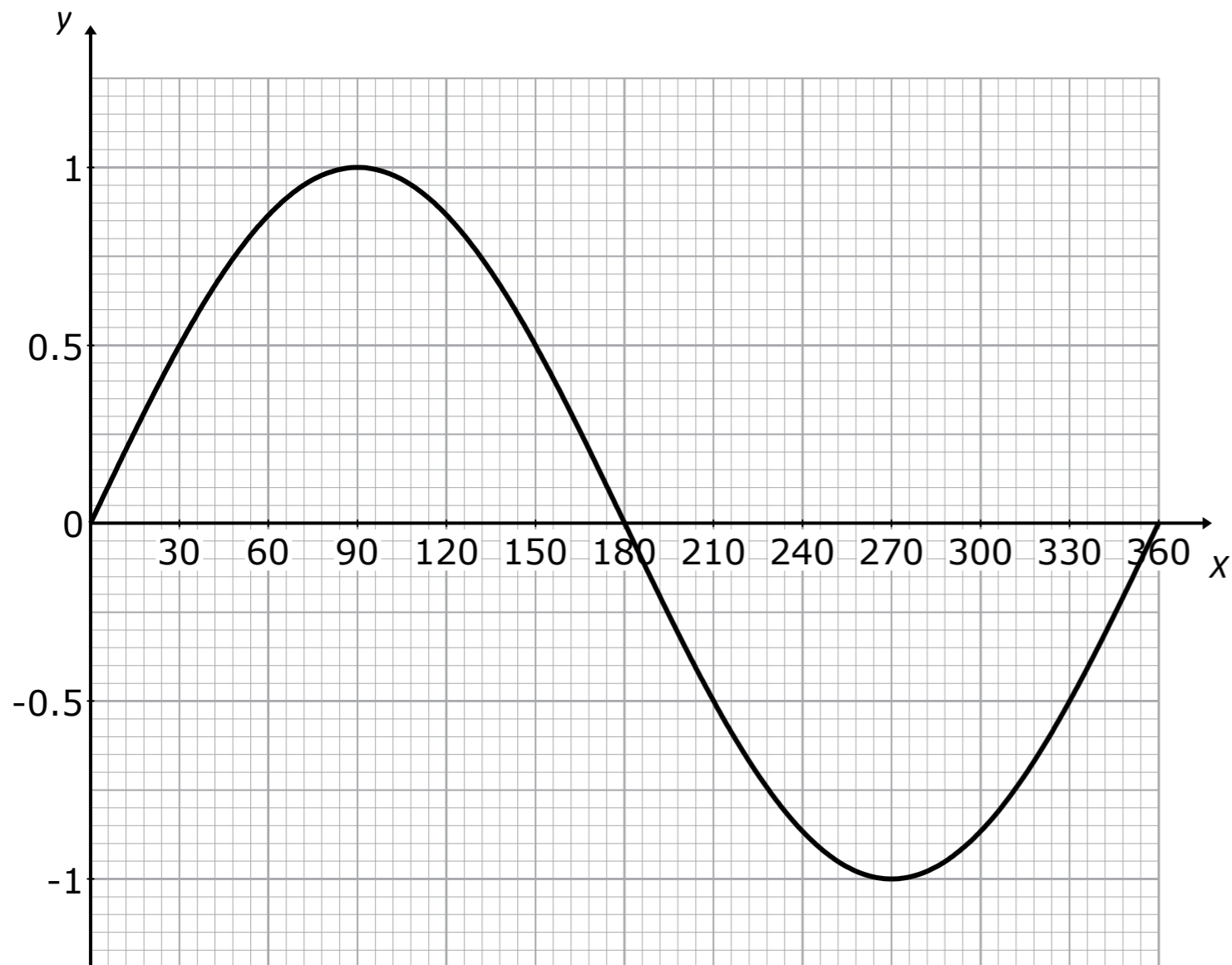
Find the graph that shows a linear function.

(1)

Select **one** option.



The graph of $y = \sin x$ is drawn on the grid.



(a) Identify the part of the graph with coordinates $(90, 1)$ (1)



Drag the dot onto the graph to the correct coordinates.

(b) Find the value of y when $x = 270$ (1)

Select **one** option.

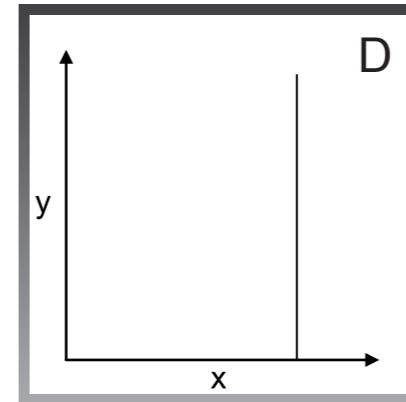
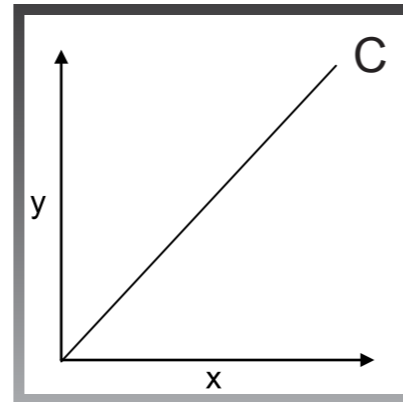
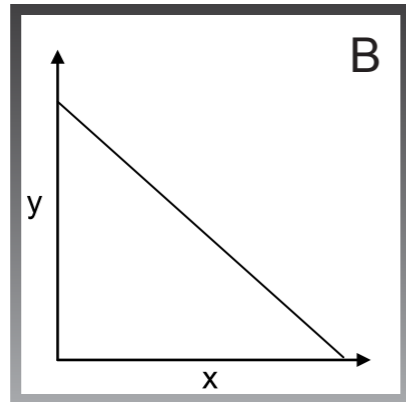
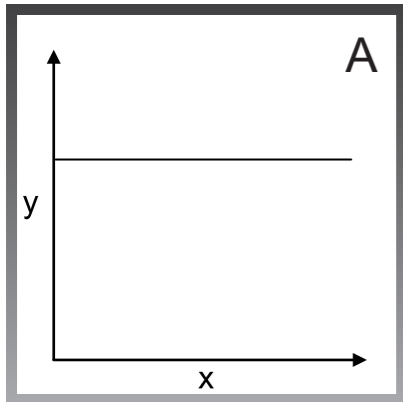
 -1 -0.5 0 1

Here are four graphs.

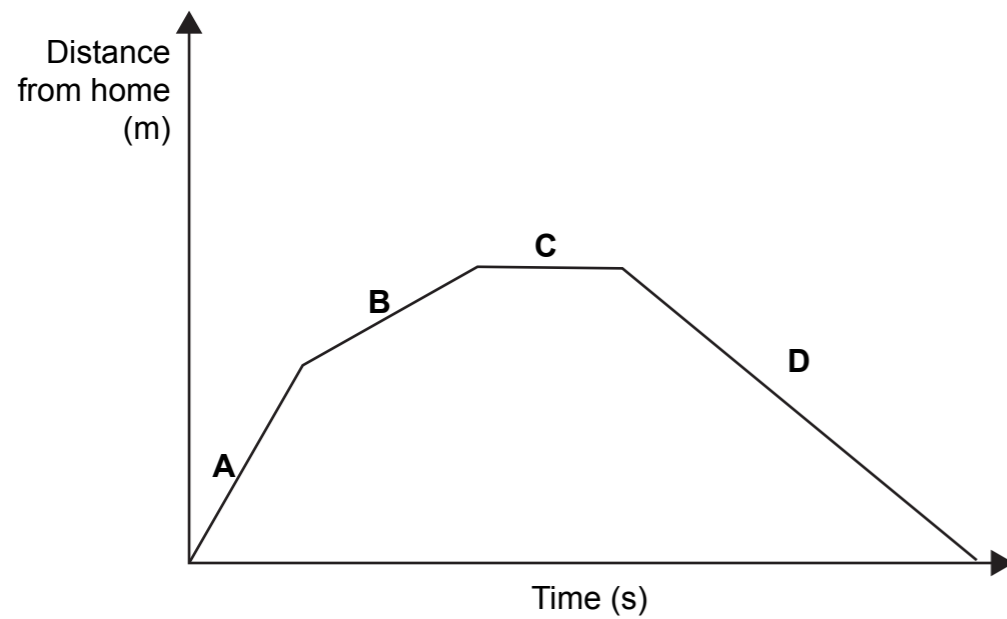
Find one that shows a positive gradient.

(1)

Select **one** option.



This is a distance-time graph for a vehicle.



(a) Choose the statement that describes the vehicle's motion in Section A. (1)

Select **one** option.

constant velocity stationary

accelerating returning home

(b) Identify the section of the graph where the vehicle is **not** moving. (1)

Click on the section of the graph where the vehicle is **not** moving.

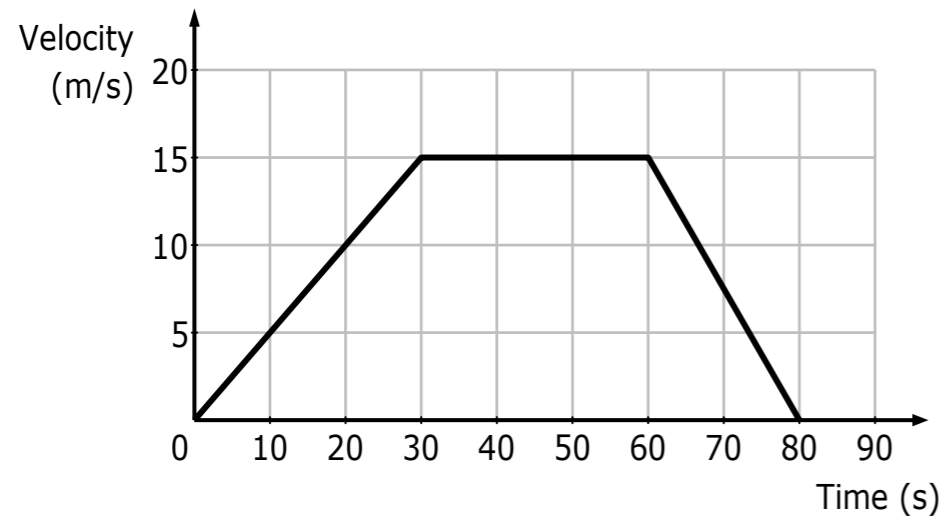
(c) Which section of the graph has the **greatest** velocity. (1)

Select **one** option.

A B

C D

This is a velocity-time graph for a vehicle.



(a) Calculate the acceleration of the vehicle for the **first 30** seconds of the journey. (1)

Select **one** option.

-0.5 m/s²

0.5 m/s²

1 m/s²

2 m/s²

(b) Calculate the distance travelled by the vehicle in the **last 20** seconds of the journey. (1)

Select **one** option.

75 m

150 m

300 m

450 m



What is the base unit for mass?

(1)

Select **one** option.

grams

kilograms

newtons

pounds

A plane flies a distance of 5600 km in 7 hours.

Calculate the average speed of the plane.

(1)

Type your answer in the box.

km/h



Choose the statement that describes the velocity of a plane.

(1)

Select **one** option.

- The plane is travelling at a speed of 650 km/h.
- The plane is travelling on a bearing of 120° at a speed of 650 km/h.
- The plane is travelling north at a height of 10km.
- The plane is travelling on a bearing of 120° at a height of 10km.



There are five different variables used in the equations of motion. Two examples are given.

Match each variable with its description.

(2)

Click on **each** variable and then select the correct description.

Variable

v

s

Description

acceleration

time

final velocity

displacement

initial velocity

A vehicle accelerates from 10m/s to 30m/s in 5 seconds.

Calculate the acceleration of the vehicle.

(1)

Type your answer in the box.

m/s²

An aircraft starts from rest. 5 seconds later the aircraft has a velocity of 10 m/s.

Calculate the distance travelled by the aircraft in these 5 seconds.

(1)

Type your answer in the box.

 m



An aircraft of mass 1800 kg travels along a runway. It has a constant acceleration of 3.6 m/s^2

Calculate a force needed to produce this acceleration.

(1)

Type your answer in the box.

newtons



A fork lift truck lifts a 150 kg load 4 metres vertically from ground level.

(a) Calculate the gain in gravitational potential energy by the load. (1)

Type your answer in the box.

 J

(b) Calculate the work done on the load to lift it. (1)

Type your answer in the box.

 J



Here are three conversions:

$1 \text{ inch} = 25.4 \text{ mm}$

$1 \text{ kg} = 2.2 \text{ pounds}$

$1 \text{ gallon} = 4.5 \text{ litres}$

Use these conversions to complete the statements.

(4)

Enter your answers in the boxes.

(a) 3 inches = mm

(b) 5 kg = pounds

(c) 18 litres = gallons

(d) 381 mm = inches



Micro and mega are two prefixes used with SI units.

Match each prefix with its symbol.

(2)

Click on **each** prefix and then select the correct symbol.

Prefix

micro

mega

Symbol

m

μ

M

G

a



Calculate the number of millimetres in 10 metres.

(1)

Select **one** option.

100

1000

10 000

100 000



1 US gallon is approximately 3.875 litres. 1 UK gallon is approximately 4.5 litres.

Identify the calculation to convert 1 US gallon into UK gallons.

(1)

Select **one** option.

$4.5 \div 3.875$

4.5×3.875

$3.875 \div 4.5$

$4.5 - 3.875$