

(b) The total area of the metal (unshaded) sections of the cover is $\frac{55}{3}\pi \text{ cm}^2$.

(i) Calculate the total area of the shaded sections, giving your answer in terms of π .

Answer cm^2 [1]

(ii) Calculate the fraction of the total area of the cover that is metal (unshaded).
Give your answer in its simplest form.

Answer [1]

20 (a) Evaluate

(i) $5^0 + 5^2$,

Answer [1]

(ii) $36^{\frac{1}{2}}$,

Answer [1]

(iii) $(2^{\frac{2}{3}})^6$.

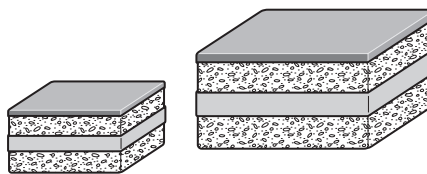
Answer [1]

(b) $\left(\frac{1}{3}\right)^k = 9$

Find the value of k .

Answer $k =$ [1]

- 16 Maryam makes two geometrically similar cakes. The heights of the cakes are 6 cm and 9 cm.



For
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Use

- (a) Maryam decorates each cake with a ribbon around the outside. The length of the ribbon for the larger cake is 66 cm.

Find the length of the ribbon for the smaller cake.

Answer cm [1]

- (b) Maryam uses 1600 m^3 of cake mixture to make the smaller cake.

Find the volume of cake mixture she uses to make the larger cake.

Answer cm^3 [2]

17 $p = 2.4 \times 10^2$ $q = 6 \times 10^3$

Giving your answers in standard form, find

- (a) $p + q$,

Answer [1]

- (b) $2p \div q$.

Answer [2]

18 A book gives the following estimates of populations in the year 2000.
Assuming this information to be correct, find

- (a) the total population of Africa and Asia, giving your answer in standard form,
- (b) the ratio of the population of Singapore to that of the World, expressing your answer in the form 1 : n .

World	6.2×10^9
Africa	8.5×10^8
Asia	3.7×10^9
Singapore	3.1×10^6

Answer (a) [2]

(b) 1 : [2]

19 Trains take 3 hours 42 minutes to travel between Aston and Barford.

- (a) One train left Aston at 07 30. When did it arrive at Barford?
- (b) On the return journey it reached Aston at 18 30. When did it leave Barford?
- (c) (i) Express the journey time (3 hours 42 minutes) in hours, giving your answer as a decimal.
- (ii) The distance from Aston to Barford is 370 kilometres.
Calculate the average speed of the train, giving your answer in kilometres per hour.

Answer (a) [1]

(b) [1]

(c)(i) h [1]

(ii) km/h [1]

- 6 (a) Evaluate $4^2 + 4^1 + 4^0$.
- (b) Write down the value of $\sqrt{0.04}$.
- (c) Write down the following in order of size, starting with the smallest.

$$\frac{1}{3}, 0.3^2, 0.32.$$

Answer (a) [1]

(b) [1]

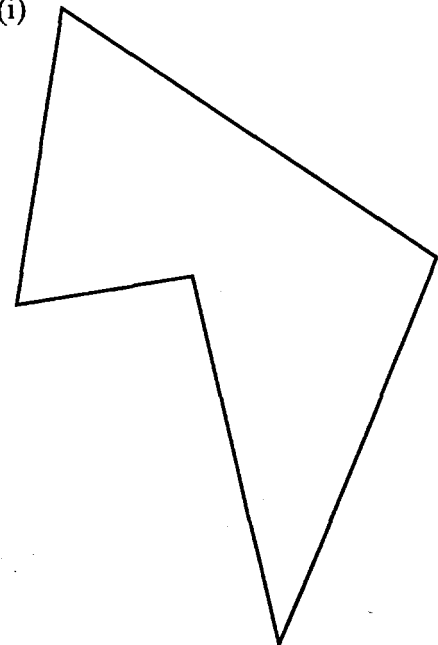
(c) [1]

- 7 (a) Calculate the sum of the interior angles of a pentagon.

Answer (a) [1]

- (b) A pentagon is shown in the answer space. (b)(i)

- (i) Mark with an arc the interior angle that is reflex.
- (ii) Measure the interior obtuse angle.



[1]

(ii) [1]

- 4 The exterior angle of a regular polygon is 15° .

How many sides does it have?

Answer [2]

- 5 Evaluate

(a) 3^{-2} ,

(b) $\left(\frac{1}{16}\right)^{\frac{1}{2}}$.

Answer (a) [1]

(b) [1]

- 6 The mass of the earth is 5.9763×10^{27} grams.

Expressing your answers in standard form, correct to 3 significant figures, write this mass

(a) in grams,

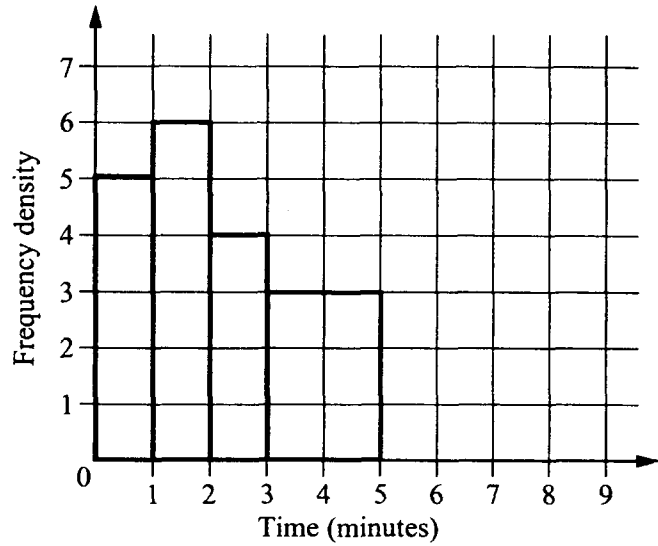
(b) in kilograms.

Answer (a) g [1]

(b) kg [1]

- 17 The time taken for some students to perform a calculation is shown in the table. Part of the corresponding histogram is shown alongside.

Time (t minutes)	Frequency
$0 < t \leq 1$	5
$1 < t \leq 2$	6
$2 < t \leq 3$	p
$3 < t \leq 5$	q
$5 < t \leq 8$	6



- (a) Find the value of p and the value of q .

Answer (a) $p = \dots\dots\dots$

$q = \dots\dots\dots$ [2]

- (b) Complete the histogram. [2]

- 18 Given that $p = 8 \times 10^9$ and $q = 4 \times 10^7$, find the value of each of the following, expressing your answers in standard form.

(a) $p \times q$.

(b) $q \div p$.

(c) $p + q$.

Answer (a) $\dots\dots\dots$ [1]

(b) $\dots\dots\dots$ [1]

(c) $\dots\dots\dots$ [2]

- 15 (a) Find the value of $2^n - n^2$
- (i) when $n = 0$,
 - (ii) when $n = 3$.
- (b) Find the value of $\left(\frac{1}{3}\right)^{-2}$.

Answer (a)(i) [1]
(ii) [1]
(b) [1]

16 $\mathbf{A} = \begin{pmatrix} 1 & -2 \\ 0 & x \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 1 & 4 \\ y & 2 \end{pmatrix}$.

- (a) Find \mathbf{AB} .
- (b) Given that \mathbf{B} is the inverse of \mathbf{A} , write down the value of x and the value of y .

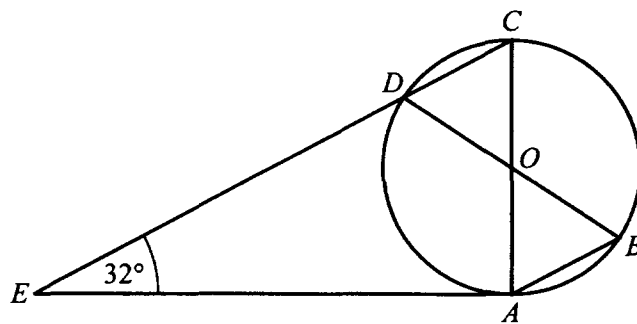
Answer (a) [2]
(b) $x =$ $y =$ [1]

- 8 (a) Calculate the exact value of $\sqrt[3]{8 \times 10^6}$.
- (b) The population of Nigeria was recently estimated to be 103 940 000.
Express 103 940 000 in standard form, correct to 3 significant figures.

Answer (a) [1]

(b) [2]

9



In the diagram, O is the centre of the circle $ABCD$.
The straight lines AC and BD intersect at O .
The tangent at A meets CD produced at E and $\widehat{AED} = 32^\circ$.

Calculate

(a) \widehat{ABD} ,

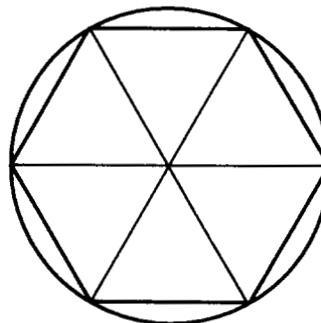
(b) \widehat{AOD} .

Answer (a) $\widehat{ABD} =$ [2]

(b) $\widehat{AOD} =$ [1]

- 4 The diagram in the answer space shows a regular hexagon inscribed in a circle. Shade two **segments** of the circle so that the shaded diagram has rotational symmetry of order 2.

Answer



[2]

-
- 5 Evaluate

(a) $\left(\frac{3}{10}\right)^2$,

(b) 5^{-2} .

Answer (a) [1]

(b) [1]

4 Evaluate

(a) $7^2 - 7^1 + 7^0$,

(b) $16^{-\frac{1}{2}}$.

Answer (a) [1]

(b) [1]

5 The temperature on the surface of the moon in the middle of the day was 126°C .
The temperature on the surface of the moon in the middle of the night was -154°C .

(a) By how much did the temperature decrease during this period?

(b) Find the average of the temperatures in the middle of the day and the middle of the night.

Answer (a) $^\circ\text{C}$ [1]

(b) $^\circ\text{C}$ [1]

6 (a) Find the gradient of the straight line $5x + y = 14$.

(b) The point $(p, 2p)$ lies on the straight line $x + 4y = 36$.

Calculate the value of p .

Answer (a) [1]

(b) $p =$ [2]

**NEITHER ELECTRONIC CALCULATORS NOT MATHEMATICAL TABLES MAY
BE USED IN THIS PAPER**

1 Find the value of

(a) 0.2×0.45 ,

(b) $1\frac{3}{5} \div 2\frac{1}{3}$.

Answer (a) [1]

(b) [1]

2 Find the value of

(a) $\sqrt{0.0081}$,

(b) $7^3 \times 7^{-3}$.

Answer (a) [1]

(b) [1]

3 On four occasions a bus takes the following times to complete a journey.

$1\frac{2}{3}$ hours, 1.7 hours, 1 hour 39 minutes, $1\frac{3}{4}$ hours.

By first expressing these times in minutes, write them in order of size, starting with the smallest.

Answer minutes < minutes < minutes < minutes [2]

- 4 Each interior angle of a regular polygon is 150° .
Calculate the number of sides of the polygon.

Answer [2]

- 5 (a) Evaluate $15.05 \div 0.5$.
- (b) The rate of exchange between Swiss francs (F) and British pounds (£) was $2.4F = \text{£}1$.
Calculate the number of pounds received in exchange for 60F.

Answer (a) [1]

(b) £ [1]

- 6 (a) On a journey, a cyclist travelled 1 kilometre in x minutes.
On a second journey, the cyclist travelled for y hours at the same average speed as on the first journey.
Find an expression, in terms of x and y , for the number of kilometres he travelled on the second journey.

(b) $\frac{t \times t^3}{\sqrt{t}} = t^n$.

Find the value of n .

Answer (a) km [1]

(b) $n =$ [1]

**NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES
MAY BE USED IN THIS PAPER.**

- 1 (a) Calculate the value of 0.1×0.06 .
- (b) Find the decimal number exactly halfway between 1.01 and 1.02.

Answer (a) [1]

(b) [1]

-
- 2 Giving the answer as simply as possible, calculate

(a) $\frac{3}{4} - \frac{1}{3}$,

(b) $\frac{2}{5}$ of $\frac{15}{16}$.

Answer (a) [1]

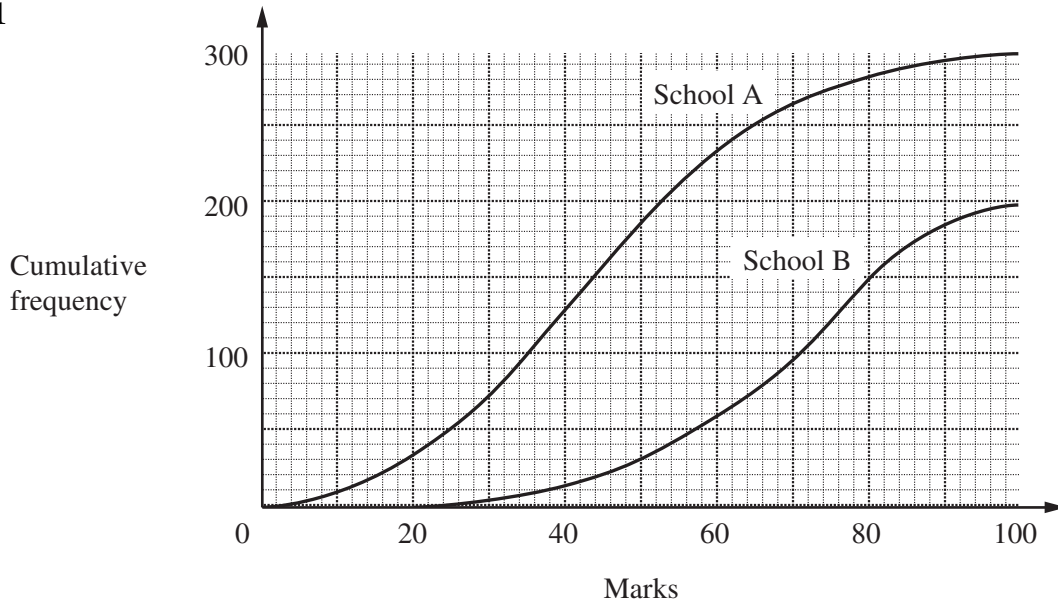
(b) [1]

-
- 3 (a) Calculate the value of $9^{\frac{1}{2}} + 9^0$.
- (b) The reciprocal of 2^{-3} is 2^n .
Write down the value of n .

Answer (a) [1]

(b) $n =$ [1]

11



All the students from two schools, *A* and *B*, take the same examination paper. The cumulative frequency curves show the results for the two schools.

- (a) Estimate the median mark of the students from school *A*.
- (b) Estimate the percentage of the students from school *B* who gained more than 80 marks.
- (c) State, with a reason, which school achieved the better results.

Answer (a) [1]

(b) % [1]

Answer (c) School because
..... [1]

12 Find *a*, *b* and *c* when

- (a) $3^a \div 3^5 = 27$,
- (b) $125^b = 5$,
- (c) $10^c = 0.001$.

Answer (a) *a* = [1]

(b) *b* = [1]

(c) *c* = [1]

- 6 (a) Express 99 as the product of its prime factors.
- (b) Find the smallest possible integer value of n for which $99n$ is a multiple of 24.

Answer (a) [1]

(b) [1]

-
- 7 (a) It is given that $5^{-2} \times 5^k = 1$.
Write down the value of k .
- (b) It is given that $\sqrt[3]{7} = 7^m$.
Write down the value of m .

Answer (a) $k =$ [1]

(b) $m =$ [1]

-
- 8 (a) Add together 37 kilograms and 40 grams.
Give your answer in kilograms.
- (b) The length of a piece of string is 0.026 metres, correct to the nearest millimetre.
Write down, in millimetres, the lower bound of this length.

Answer (a) kg [1]

(b) mm [1]

- 4 (a) Simplify $(3x^3)^2$.
- (b) Given that $(16)^{\frac{1}{2}} \times k = 1$, evaluate k .

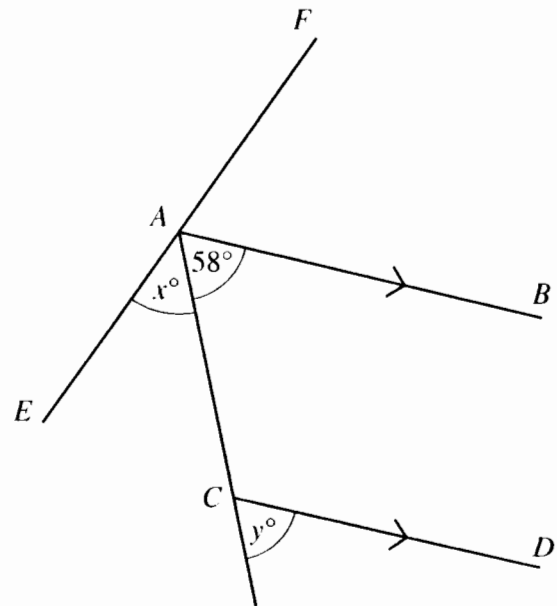
Answer (a) [1]

(b) $k =$ [1]

- 5 In the diagram, EAF is a straight line and AB is parallel to CD .
 AB bisects $F\hat{A}C$ and $C\hat{A}B = 58^\circ$.

Find the value of

- (a) x ,
- (b) y .



Answer (a) $x =$ [1]

(b) $y =$ [1]

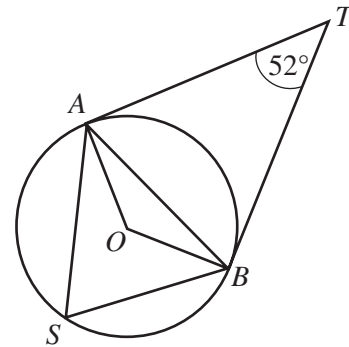
- 6 Given that $A = \begin{pmatrix} 3 & -1 \\ 4 & 2 \end{pmatrix}$,
 find

- (a) the determinant of A ,
- (b) A^{-1} .

Answer (a) [1]

(b) [1]

- 14** A, B and S are points on a circle, centre O .
 TA and TB are tangents.
 $\hat{ATB} = 52^\circ$.



Calculate

- (a) \hat{AOB} ,
- (b) \hat{OBA} ,
- (c) \hat{ASB} .

Answer (a) $\hat{AOB} = \dots\dots\dots$ [1]

(b) $\hat{OBA} = \dots\dots\dots$ [1]

(c) $\hat{ASB} = \dots\dots\dots$ [1]

- 15** It is given that $N = 87 \times 132$.

- (a) Complete the statements in the answer space.

Answer (a) $88 \times 132 = N + \dots\dots\dots$ [1]

$87 \times 131 = N - \dots\dots\dots$ [1]

- (b) Hence evaluate $88 \times 132 - 87 \times 131$.

Answer (b) $\dots\dots\dots$ [1]

- 16** (a) The number 222.222 is written in the answer space.
 Circle the digit which represents the value 2×10^0 .

- (b) Write 5×10^{-2} as a fraction in its simplest form.

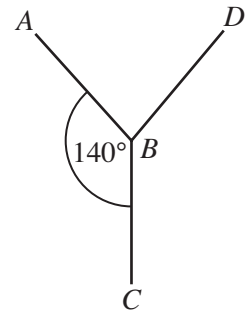
- (c) Evaluate $8^{\frac{2}{3}}$.

Answer (a) 222.222 [1]

(b) $\dots\dots\dots$ [1]

(c) $\dots\dots\dots$ [1]

- 12** AB and BC are adjacent sides of a regular polygon.
 $\hat{ABC} = 140^\circ$.



- (a) Calculate the number of sides of the polygon.
- (b) CB and BD are adjacent sides of a congruent regular polygon.
Calculate \hat{ABD} .

Answer (a)[2]

(b) $\hat{ABD} =$ [1]

- 13** (a) Evaluate $5^2 + 5^0$.

- (b) Simplify

(i) $\left(\frac{1}{x}\right)^{-2}$,

(ii) $\left(x^6\right)^{\frac{1}{2}}$.

Answer (a)[1]

(b)(i) [1]

(ii) [1]

- 14** (a) $f(x) = (x + 2)(2x - 1)$.
Evaluate $f(5.5)$.

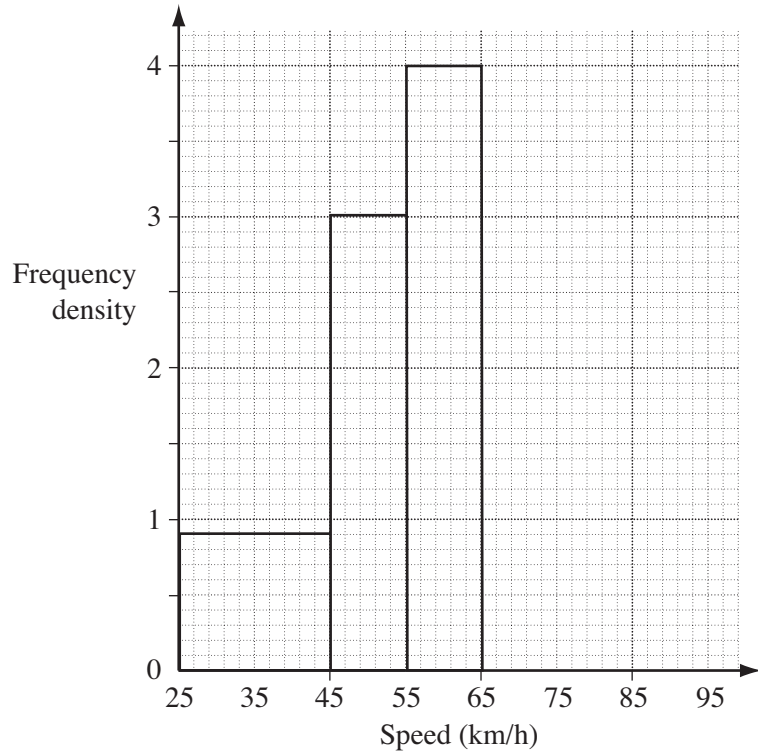
- (b) $g(x) = \frac{1}{3}(2x - 1)$.
Find $g^{-1}(5)$.

Answer (a) $f(5.5) =$ [1]

(b) $g^{-1}(5) =$ [2]

- 11** On a certain stretch of road, the speeds of some cars were recorded. The results are summarised in the table. Part of the corresponding histogram is shown alongside.

Speed (x km/h)	Frequency
$25 < x \leq 45$	q
$45 < x \leq 55$	30
$55 < x \leq 65$	p
$65 < x \leq 95$	12



- (a) Find the value of

- (i) p ,
(ii) q .

Answer (a)(i) $p = \dots\dots\dots$ [1]

(ii) $q = \dots\dots\dots$ [1]

- (b) Complete the histogram. [1]

- 12** Evaluate

- (a) 17^0 ,
(b) $4^{\frac{5}{2}}$,
(c) $(0.2)^{-2}$.

Answer (a) $\dots\dots\dots$ [1]

(b) $\dots\dots\dots$ [1]

(c) $\dots\dots\dots$ [1]

17 A straight line passes through the points $P(1, 2)$ and $Q(5, -14)$.

Find

- (a) the coordinates of the midpoint of PQ ,
- (b) the gradient of PQ ,
- (c) the equation of PQ .

Answer (a) (.....,) [1]

(b)[1]

(c)[2]

18 The Earth is 1.5×10^8 kilometres from the Sun.

- (a) Mercury is 5.81×10^7 kilometres from the Sun.

How much nearer is the Sun to Mercury than to the Earth?
Give your answer in standard form.

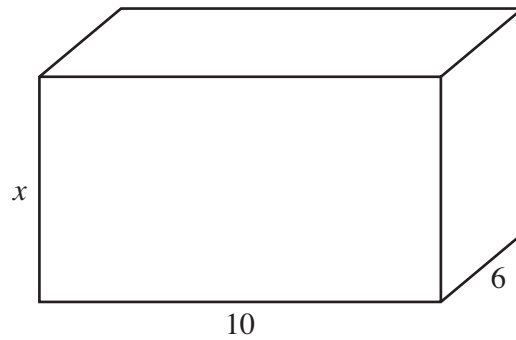
- (b) A terametre is 10^{12} metres.

Find the distance of the Earth from the Sun in terametres.

Answer (a) km [2]

(b) terametres [2]

- 7 The diagram shows a solid cuboid with base 10 cm by 6 cm.
The height of the cuboid is x centimetres.



- (a) Find an expression, in terms of x , for the total surface area of the cuboid.
(b) The total surface area of the cuboid is 376 cm^2 .

Form an equation in x and solve it to find the height of the cuboid.

Answer (a) cm^2 [1]

(b) cm [2]

- 8 Evaluate

(a) 9^0 ,

(b) 9^{-2} ,

(c) $9^{\frac{3}{2}}$.

Answer (a)[1]

(b)[1]

(c)[1]

7 (a) Simplify $4a^3 \times a^2$.

Answer (a) [1]

(b) Simplify fully $3x(x + 5) - 2(x - 3)$.

Answer (b) [2]

8 (a) Convert 0.8 kilometres into millimetres.

Answer (a) mm [1]

(b) Evaluate $(6.3 \times 10^6) \div (9 \times 10^2)$, giving your answer in standard form.

Answer (b) [2]

9 $\vec{AB} = \begin{pmatrix} 3 \\ -4 \end{pmatrix}$

(a) Find $|\vec{AB}|$.

Answer (a) [1]

(b) A is the point (0, 2).

(i) The equation of the line AB may be written $3y + 4x = k$.
Find the value of k .

Answer (b)(i) $k =$ [1]

(ii) Find the coordinates of the midpoint of AB .

Answer (b)(ii) (.....,) [1]

10 (a) Evaluate $5^0 - 5^{-1}$.

Answer (a) [1]

(b) Simplify $(5x^3)^2$.

Answer (b) [1]

(c) Simplify $\left(\frac{16}{n^{16}}\right)^{\frac{1}{2}}$.

Answer (c) [1]

- 3 (a) In a town, 11 000 people out of the total population of 50 000 are aged under 18.

What percentage of the population is aged under 18?

For
Examiner's
Use

Answer (a) % [1]

- (b) A company employing 1200 workers increased the number of workers by 15%.

How many workers does it now employ?

Answer (b) [1]

4 Evaluate

(a) $9^1 + 9^0$,

Answer (a) [1]

(b) $\left(\frac{1}{9}\right)^{\frac{1}{2}}$.

Answer (b) [1]

- 5 (a) Express the number 0.000 042 in standard form.

Answer [1]

- (b) Calculate $(7 \times 10^{-3}) \times (3 \times 10^9)$, giving your answer in standard form.

Answer [1]

- 6 (a) Solve the inequality $2(4 - x) < x - 10$.

Answer x [1]

- (b) Find the smallest integer n such that $3n > -17$.

Answer $n =$ [1]

- 7 (a) Evaluate $4^0 - 4^{-2}$.

Answer [1]

- (b) Simplify $(2x^2)^3$.

Answer [1]

20 The table shows the distribution of the number of complete lengths swum by a group of swimmers.

Number of complete lengths (n)	$0 < n \leq 20$	$20 < n \leq 40$	$40 < n \leq 60$	$60 < n \leq 80$
Frequency	5	20	10	5

(a) Find the modal class.

Answer [1]

(b) Calculate an estimate of the mean.

Answer [3]

21 (a) Evaluate $\left(\frac{1}{4}\right)^{-2}$.

Answer [1]

(b) Evaluate $64^{\frac{2}{3}}$.

Answer [1]

(c) Simplify $\left(\frac{4x^2y^9}{x^4y}\right)^{\frac{1}{2}}$.

Answer [2]