Answer ALL TWENTY ONE questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1   60 students sat a Mathematics exam.

The mean mark for the 32 students in Class A was 55
The mean mark for the 28 students in Class B was 52

Find the mean mark for all 60 students.

	A	B	A + B
Number of students	32	28	60
Mean	55	52	
Total marks	32 × 55 = 1760	28 × 52 = 1456	1760 + 1456 = 3216

Mean for 60 students = 3216 ÷ 60

.............................53·6.............................

(Total for Question 1 is 3 marks)

2 Teresa invests £2000 for 3 years in a savings account.
She gets 4% each year compound interest.
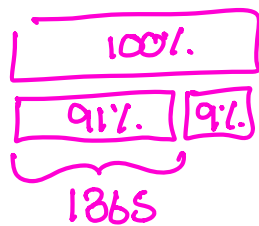
(*a*) How much money will Teresa have in her savings account at the end of 3 years?
Give your answer correct to the nearest pound.

$$100 + 4 = 104\%$$

$$104\% = 1.04$$

$$2000 \times 1.04^3$$

$$= 2249.728$$

nearest £

£ ....2250.............
(3)

Sam invested £*T*
The value of his investment decreased by 9% each year.

At the end of the first year, the value of Sam's investment was £1365

(*b*) Work out the value of *T*

100%

91%   9%

1865

$$91\% = 1365$$
$$1\% = 15$$ ÷91
$$100\% = 1500$$ × 100

.............1500.............
(3)

(Total for Question 2 is 6 marks)

3 Divya and Yuan each pay for a holiday at a special offer price.

Divya's holiday	Yuan's holiday
Normal price: $1600	Normal price: $1400
Special offer: 16% off the normal price	Special offer: k% off the normal price

The amount that Divya pays is the same as the amount that Yuan pays.

Work out the value of k

D
$100\% - 16\% = 84\%$.

1600×0.84

$= 1344$

Y
$£1344$

Difference $= 1400 - \dfrac{1344}{56}$

% $\dfrac{56}{1400} \times 100$

$= 4$

$k =$ .... 4 ....

(Total for Question 3 is 4 marks)

4 The diagram shows two solids, **A** and **B**, made from two different metals.

Handwritten (pink):
Volume
$= \pi \times 3^2 \times 7$
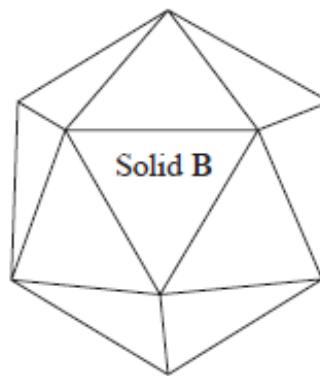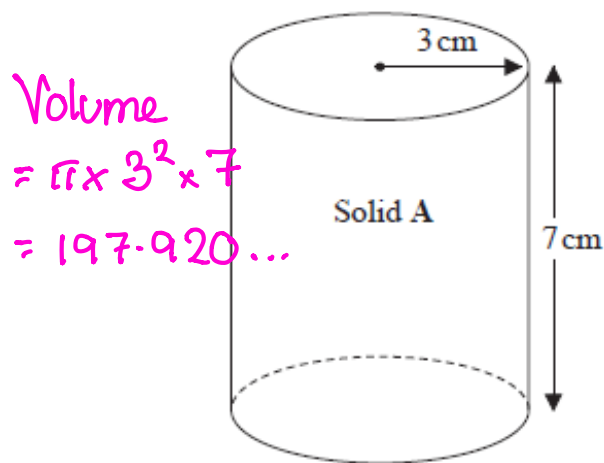$= 197.920...$

3 cm

Solid A

7 cm

Diagram NOT
accurately drawn

Solid B

Solid **A** is in the shape of a cylinder with radius 3 cm and height 7 cm
Solid **A** has a mass of 2000 g

Solid **B** has a mass of 3375 g
Solid **B** has a volume of 450 cm³

All of the metal from Solid **A** and Solid **B** is melted down to make a uniform Solid **C**

Given that there is no change to mass or volume during this process work out the density of
Solid **C**

Give your answer correct to one decimal place.

Handwritten (pink):

	A	B	C
mass	2000g +	3375g	= 5375g
Volume	197.920... +	450	= 647.920...

Density of C $= \dfrac{5375}{647.920..} = 8.2957...$ to 1 dp

........................**8·3**........................ g / cm³

(Total for Question 4 is 3 marks)

5 (*a*) Find the highest common factor (HCF) of 200 and 420

$$200 = 2^3 \times 5^2$$
$$420 = 2^2 \times 3 \times 5 \times 7$$
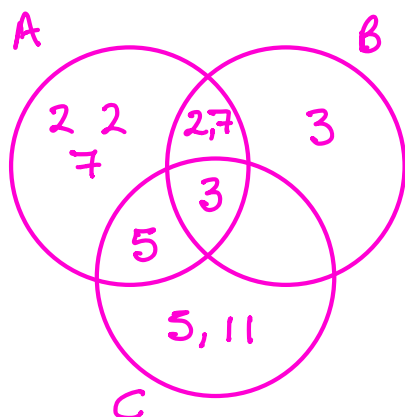$$HCF = 2^2 \times 5$$
$$= 4 \times 5$$

.... 20 ....

(2)

$A = 2^3 \times \underline{3} \times 5 \times 7^2$
$B = 2 \times 3^2 \times 7$
$C = \underline{3} \times 5^2 \times 11$

(*b*) Find the lowest common multiple (LCM) of *A, B* and *C*
Write your answer as a product of powers of prime factors.

A

B

2 2
7

2,7

3

3

5

5, 11

C

$$LCM = 2^3 \times 3^2 \times 5^2 \times 7^2 \times 11$$

$$2^3 \times 3^2 \times 5^2 \times 7^2 \times 11$$
....

(2)

(Total for Question 5 is 4 marks)

6 *C* grams of chocolate is shared in the ratios 2 : 5 : 8
The difference between the largest share and the smallest share is 390 grams.

Work out the value of *C*

$$\overset{C}{(2) : 5 : (8)}$$

Difference = 6

$$390 \div 6 = 65$$

$$65 \times 2 \qquad 65 \times 5 \qquad 65 \times 8$$
$$130 \qquad 325 \qquad 520$$

$$C = 130 + 325 + 520$$

C = ... 975 ....

(Total for Question 6 is 3 marks)

7 The table shows information about the frame size, in cm, of 60 bicycles sold in a shop.

Frame size (S cm)	Frequency
$30 < S \le 36$ **33**	4
$36 < S \le 42$ **39**	14
$42 < S \le 48$ **45**	18
$48 < S \le 54$ **51**	19
$54 < S \le 60$ **57**	5

60

(*a*) Write down the modal class.

$48 < S \le 54$

(1)

(*b*) Work out an estimate for the mean frame size.

$$33 \times 4 = 132$$
$$39 \times 14 = 546$$
$$45 \times 18 = 810$$
$$51 \times 19 = 969$$
$$57 \times 5 = 285$$
$$\overline{}$$
$$2742$$

Estimate of the
Mean $= \dfrac{2742}{60}$

$= 45.7$

45.7 .... cm

(4)

(Total for Question 7 is 5 marks)

8   In a bag, there are only red counters, blue counters, green counters and yellow counters.

The total number of counters in the bag is 80

In the bag

the number of red counters is $x + 7$
the number of blue counters is $x - 11$
the number of green counters is $3x$

Jude takes at random a counter from the bag.

The probability that he takes a red counter is $\dfrac{1}{4}$

Work out the probability that Jude takes a yellow counter.

R $\qquad$ B $\qquad$ 80 $\qquad$ G $\qquad$ Y

$x+7$ $\qquad$ $x-11$ $\qquad$ $3x$ $\qquad$?

$P(R) = \dfrac{1}{4} = \dfrac{x+7}{80}$

$\dfrac{80}{4} - 7 = x \qquad$ so $x = 13$

Yellow $= 76 - 5 \times 13$
$= 11$

R $\qquad$ B $\qquad$ G $\qquad$ Y
20 $\qquad$ 2 $\qquad$ 39 $\qquad$ $80 - (20+2+39)$
$= 19$

$P(Y) = \dfrac{19}{80}$

$^{19}\!/_{80}$

....

(Total for Question 8 is 4 marks)

9 The diagram shows a solid triangular prism.
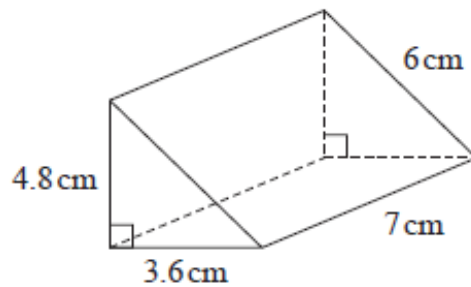

6 cm

Diagram **NOT** accurately drawn

4.8 cm

7 cm

3.6 cm

Work out the **total** surface area of the triangular prism.
Give your answer correct to 3 significant figures.

$\triangle \times 2$ $\frac{1}{2}$ 4·8 × 3·6   = 8·64   ×2 = 17·28

Base   3·6 × 7   = 25·2

Slope   7 × 6   = 42

Back   7 × 4·8   = 33·6
                                          ————

                                     118·08

                                       3 s.f.

.................**118**................................ cm²

(Total for Question 9 is 3 marks)

10 The diagram shows an isosceles triangle *ABC*

Diagram **NOT**
accurately drawn

C

y cm   *y* cm

h = 12 cm

A 7 cm B
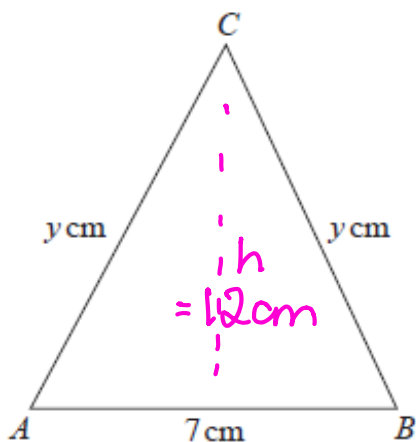
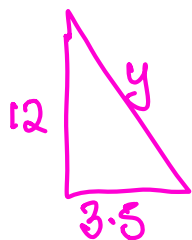*AB* = 7 cm *AC* = *BC* = *y* cm

The area of the triangle is 42 cm^2

Work out the value of *y*

$42 = \frac{1}{2} \times 7 \times h$

$h = \frac{42 \times 2}{7} = 12\,cm$

12

y

3.5

$y^2 = 12^2 + 3.5^2$

$= 156.25$

$y = \sqrt{156.25}$

$= 12.5$

y = ... 12.5 ....

(Total for Question 10 is 4 marks)

**11** The table shows information about the times, in minutes, that 80 patients had to wait to see a doctor.

Time (W minutes)	Frequency
$0 < W \leq 10$	7
$10 < W \leq 20$	10
$20 < W \leq 30$	15
$30 < W \leq 40$	32
$40 < W \leq 50$	16

(*a*) Complete the cumulative frequency table below.

Time (W minutes)	Cumulative frequency
$0 < W \leq 10$	7
$0 < W \leq 20$	17
$0 < W \leq 30$	32
$0 < W \leq 40$	64
$0 < W \leq 50$	80

(1)

(*b*) On the grid on the next page, draw a cumulative frequency graph for your table.

You cure
may differ
slightly
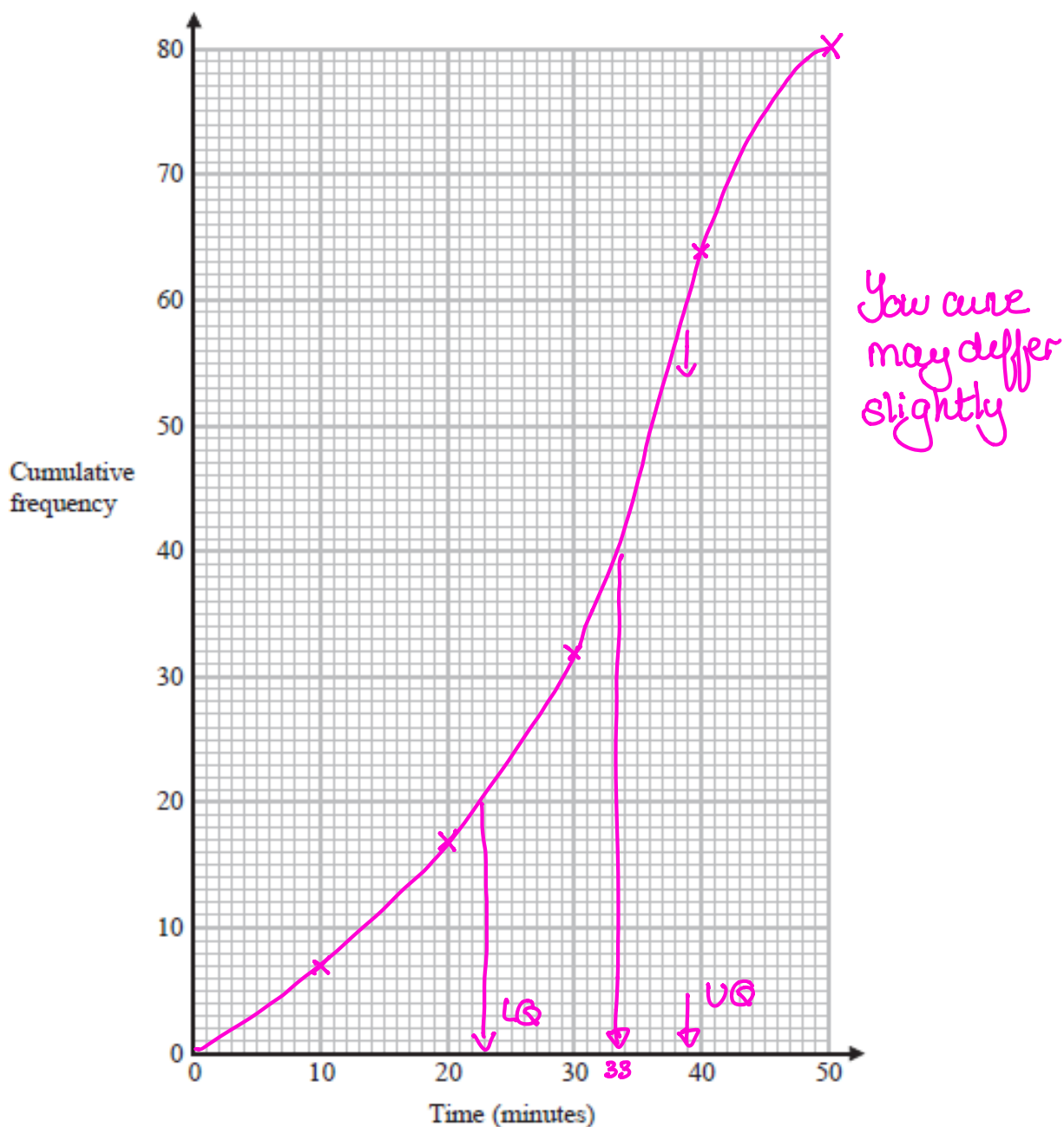
(2)

(*c*) Use your graph to find an estimate for the median.

................................33................................ minutes

range of 32 to 34 accepted **(1)**

(*d*) Use your graph to find an estimate for the interquartile range.

LQ = 23   UQ = 39

IQR = 16

................................16................................ minutes

range of 15 to 17 accepted **(2)**

(Total for Question 11 is 6 marks)

12 $T = \dfrac{p}{r}$

$p = 0.51$ correct to 2 significant figures.
$r = 6.3$ correct to 2 significant figures.

Work out the upper bound for the value of T
Show your working clearly.

$p = 0.51 \nearrow 0.515$
$ \searrow 0.505$

$r = 6.3 \nearrow 6.35$
$ \searrow 6.25$
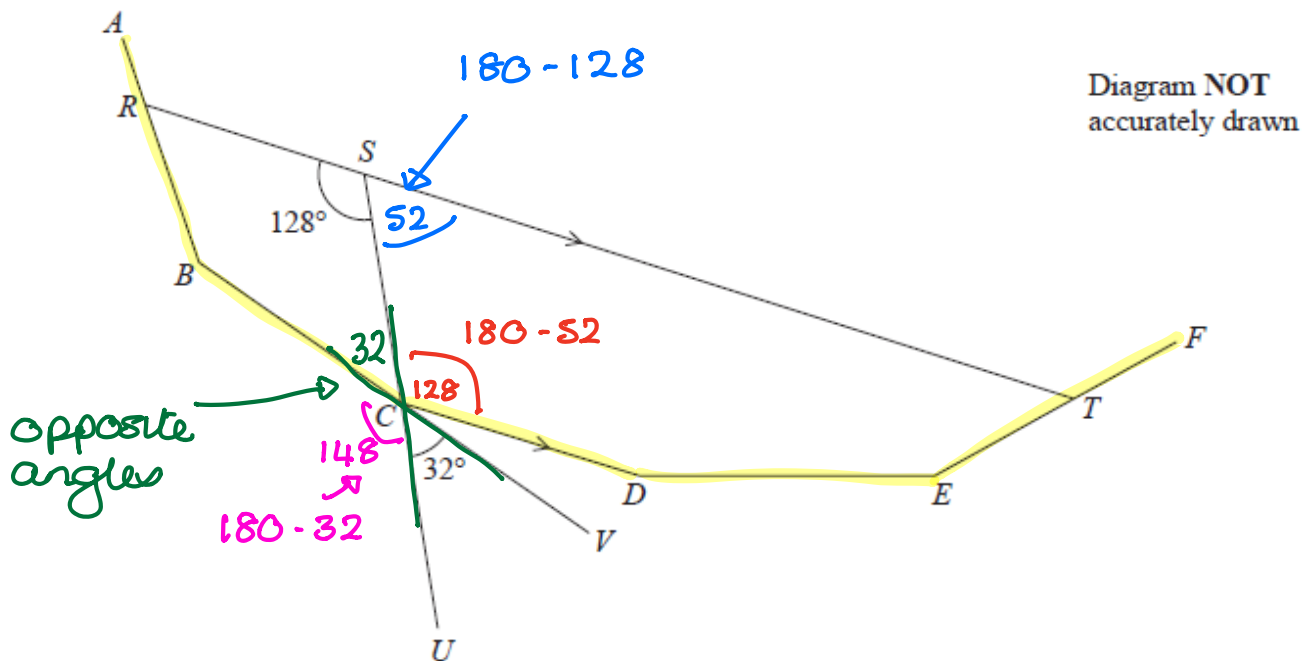
$T_{ub} = \dfrac{0.515}{6.25}$

$= 0.0824$

0.0824

(Total for Question 12 is 2 marks)

13 Using ruler and compasses only, construct the bisector of angle BAC
You must show all your construction lines.
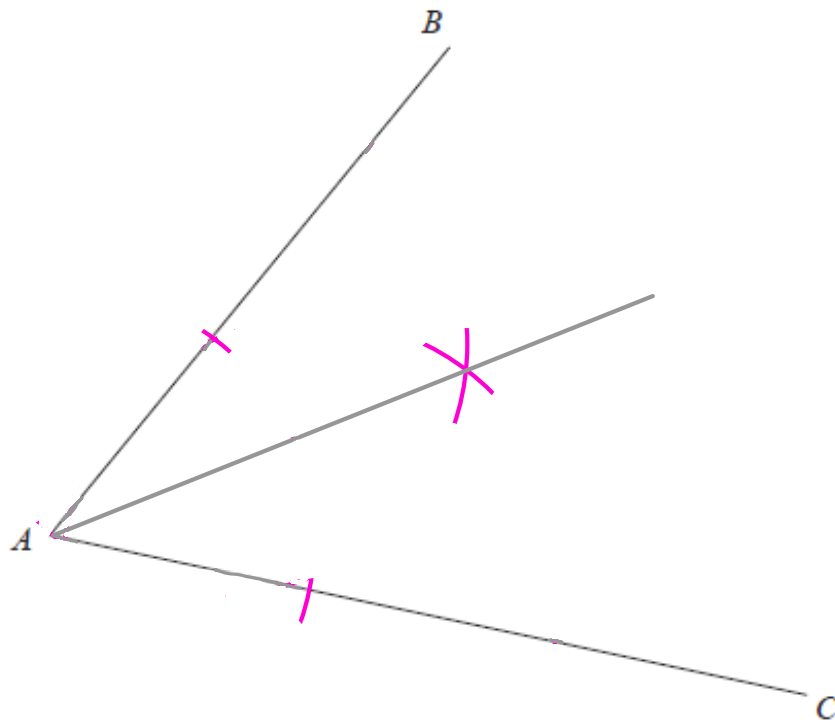
(Total for Question 13 is 2 marks)

14

Diagram NOT accurately drawn

[Handwritten annotations on diagram: 180 − 128, 52, 180 − 52, 128, 32, 148, 180 − 32, "opposite angles"]

AB, *BC*, *CD*, *DE* and *EF* are five sides of a regular polygon.

RST, *SCU* and *BCV* are straight lines.
RST is parallel to *CD*
Angle *RSC* = 128°
Angle *UCV* = 32°

Work out how many sides the polygon has.
Show your working clearly.

interior angle = 32 + 128 = 160

Exterior angle = 20°

No of sides = $\frac{360}{20}$ = 18

.... 18 ....

(Total for Question 14 is 4 marks)

15 The diagram shows a triangular prism, *ABCDEF*, with a rectangular base *ABCD*
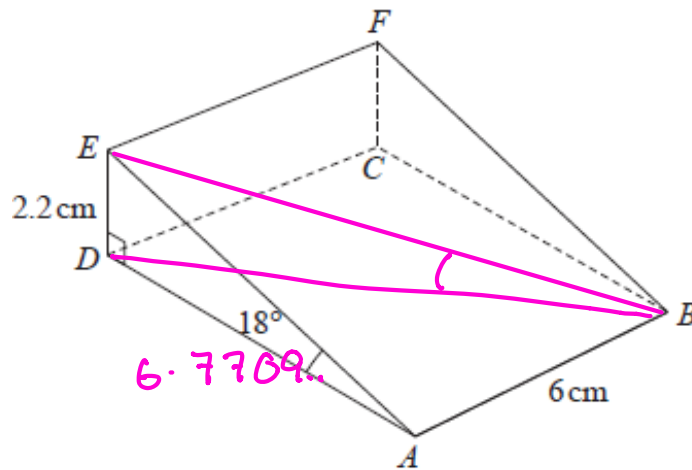
Diagram **NOT** accurately drawn
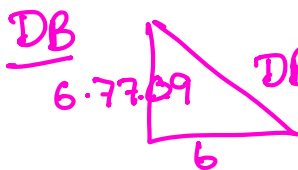
AB = 6 cm   *DE* = 2.2 cm angle   *DAE* = 18°   angle *ADE* = 90°

Work out the angle that *BE* makes with the plane *ABCD*
Give your answer correct to <mark>one decimal place</mark>.

$$\underline{AD}$$
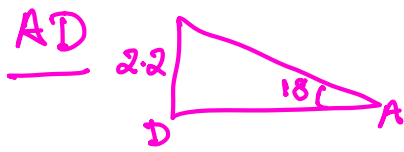
$$\tan 18 = \frac{2.2}{AD}$$

$$AD = 2.2 \div \tan 18$$
$$= 6.7709...$$

$$\underline{DB}$$

$$DB^2 = 6.77^2 + 6^2 =$$
$$DB = \sqrt{81.845...}$$
$$= 9.0468..$$

$$\underline{\text{angle}}$$ $$\tan \theta = \frac{2.2}{9.0468..}$$

$$\therefore \theta = \tan^{-1} 0.2431..   \theta = 13.667..$$
$$\text{to } 1 \, dp$$

.............**13·7**............. °

(Total for Question 15 is 4 marks)

16 A rectangle has length L and width W
L is increased by 20% $100 + 20 = 120\%$.
W is decreased by 35% $100 - 35 = 65\%$.

Calculate the percentage reduction in the area of the rectangle.

$1.2 \times 0.65 = 0.78$

so   22% reduction

$(1 - 0.78 = 0.22$
$0.22 = 22\%)$

............................22............................%

(Total for Question 16 is 3 marks)

C

Diagram **NOT**
accurately drawn

8.3 cm

5

(θ

A 4.6 cm B

area. $12 = \frac{1}{2} 4.8 \times h$

$h = \frac{12 \times 2}{4.8} = 5$
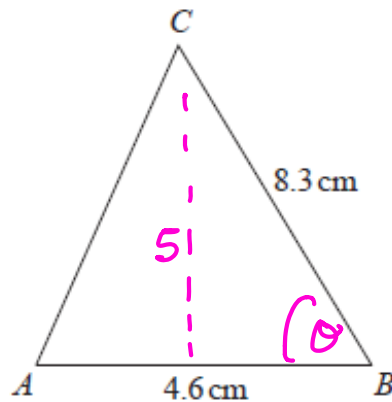
$AB = 4.6$ cm $BC = 8.3$ cm   angle ABC is acute

The area of triangle ABC is 12 cm²

Work out the perimeter of triangle ABC
Give your answer correct to 3 significant figures.

$12 = \frac{1}{2} 4.6 \times 8.3 \times \sin θ$

$\frac{12 \times 2}{4.6 \times 8.3} = \sin θ$ $θ = 38.94700...$

$AC^2 = 4.6^2 + 8.3^2 - 2 \times 4.6 \times 8.3 \times \cos 38.94..$

$= 30.6627..$

$AC = 5.53...$

so perimeter $= 5.53 + 4.6 + 8.3$

$= 18.437..$

to 3 s.f.

..............18.4.............. cm

(Total for Question 17 is 5 marks)

18 The table gives information about the time taken by each student in Year 11 to complete a homework task.

Time taken (t minutes)	Frequency	width	Frequency density
$10 < t \le 25$	15	15	1
$25 < t \le 30$	18	5	3.6
$30 < t \le 50$	32	20	1.6
$50 < t \le 60$	4	10	0.4

(*a*) On the grid, draw a histogram for this information.

Frequency density

Time taken (*t* minutes)

< 45
$= 1.6 \times 15$
24
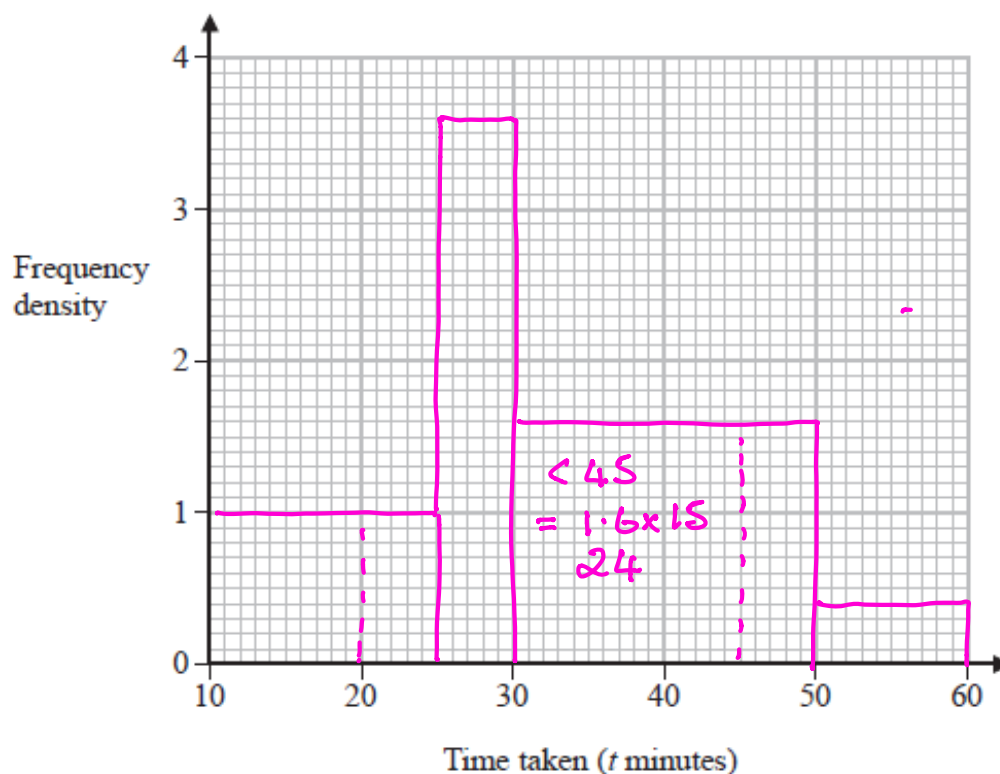
(3)

One of these students who took 50 minutes or less and more than 25 minutes to complete this homework task is chosen at random.

(*b*) Find an estimate for the probability that this student took 45 minutes or less to complete this homework task.

< 50 but > 25 mins $= 18 + 32 = 50$

$24 + 18 = 42$

$\dfrac{42}{50}$

....

(2)

(Total for Question 18 is 5 marks)

19 A statue and a model of the statue are mathematically similar.

The statue has a total surface area of 3600 cm^2
The model has a total surface area of 625 cm^2

The volume of the model is 750 cm^3

Work out the volume of the statue.

statue model

S. Area 3600cm^2 625cm^2

Volume ? 750cm^3

$$\text{area SF} = \frac{3600}{625} = 5.76$$

$$\text{length SF} = \sqrt{5.76} = 2.4$$

$$\text{Volume SF} = 2.4^3 = 13.824$$

$$750 \times 13.824$$
$$= 10\,368$$

................10,368................ cm^3

(Total for Question 19 is 3 marks)

20 Here are the numbers of aces that Rutger served in each of 11 tennis matches.

$$1 \quad 1 \quad \boxed{2} \quad 4 \quad 6 \quad \boxed{8} \quad 8 \quad 9 \quad \boxed{11} \quad 12 \quad 15$$

(*a*) Find the interquartile range of the numbers of aces.
Show your working clearly.

$$11 - 2 = 9$$

.... 9 ....
(2)

Kim also plays in 11 tennis matches.

For Kim

        the median number of aces is 11

        the interquartile range of the numbers of aces is 5

	Kim	Rutger
median	11	8
IQR	5	9

(*b*) State, giving a reason, whether Rutger or Kim

(i) served more aces on average,

...... Kim, as she has a higher median ....

....

....
(1)

(ii) was more consistent with the number of aces served.

...... Kim, as she had a smaller IQR. ....

....

....
(1)

(Total for Question 20 is 4 marks)

21 *A, B* and *C* are points on a circle, centre *O*

Diagram **NOT** accurately drawn
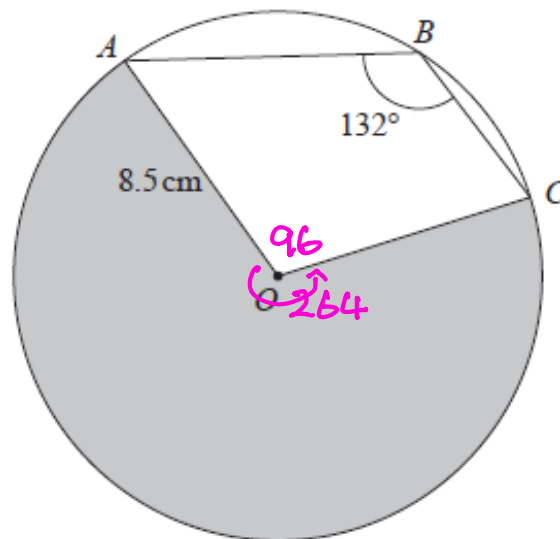
The handwritten annotations on the diagram show:
- 96
- $O\hat{} 264$
- $132 \times 2 = 264$
- $360 - 264 = 96$

The radius of the circle is 8.5 cm
Angle *ABC* = 132°

Work out the perimeter of the shaded sector *AOC*
Give your answer correct to 3 significant figures.

Perimeter $= \dfrac{264}{360} \times \pi \times (8.5 \times 2) + 8.5 + 8.5$

$= 56.1651..$
3sf

............56.2............ cm

(Total for Question 21 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS