Higher Prediction Paper 3 questions

Q1.

A company makes boxes of cereal.

A box usually contains 450 grams of cereal.

Here are two options for a special offer.

Option A	Option B
20% more cereal	Usual amount of cereal
Price remains the same	15% off the price

Which option is the better value for the customer?

You **must** show your working.

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

(Total 3 marks)

Q2.

Dipen and Nisha are planning their wedding reception.

£40 per guest Total reduced by 5% with over 60 guests

Nisha says, “I want to invite 70 guests.”

Dipen says, “If we invite one-fifth fewer guests, we will save more than £500”

Is Dipen correct?
You **must** show your working.

Answer _____

(Total 6 marks)

Q3.(a) Simplify fully $5x^2 \times 3y^4 \times 2x \times y^3$

Answer _____

(2)

(b) Expand and simplify $(x + 7)(x - 3)$

Answer _____

(2)

(c) Solve $(x - 8)(x + 2) = 0$

Answer _____

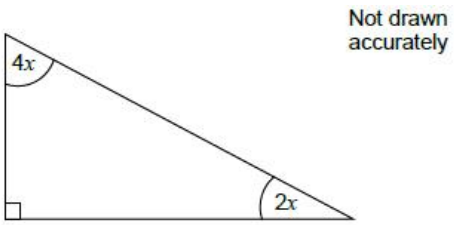
(1)

(d) Factorise $8x^2y + 6xy^2$

Answer _____

(2)(Total 7 marks)

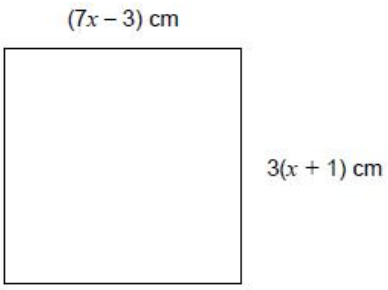
Q4. Work out the value of x.



Answer _____ degrees

(Total 3 marks)

Q5. The diagram shows a square.



Work out the length of one side of the square.

Answer _____ cm

(Total 4 marks)

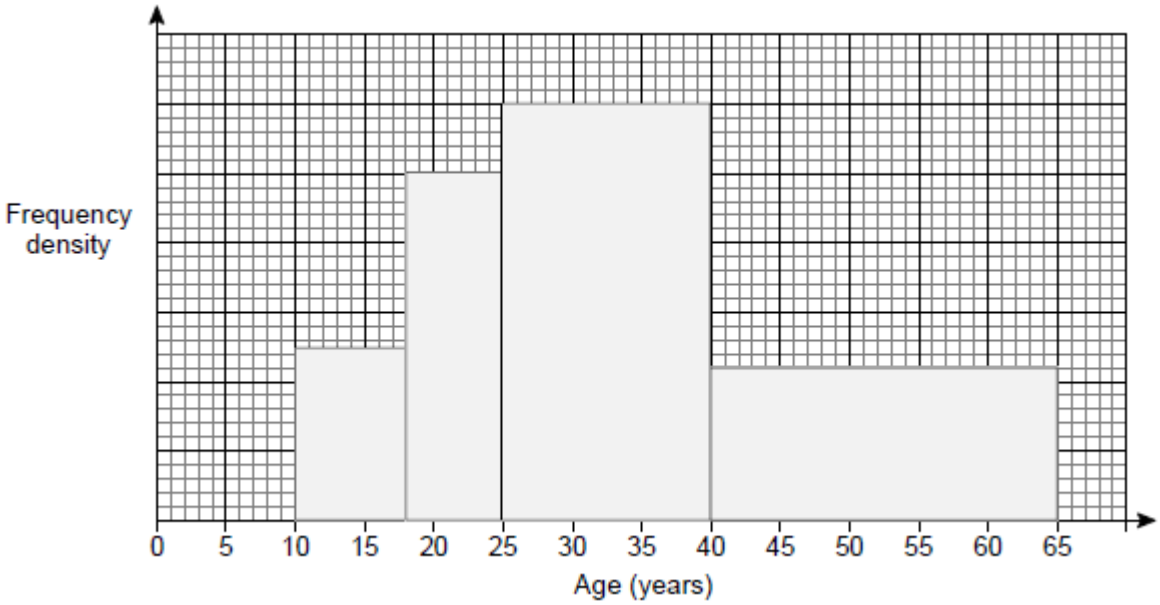
Q6.

Show that $\frac{2x+1}{3} + \frac{5x-2}{2}$ simplifies to $\frac{19x-4}{6}$

(Total 2 marks)

Q7.

The histogram shows the ages, in years, of members of a chess club.



There are 22 members with ages in the range 40 ≤ age < 65

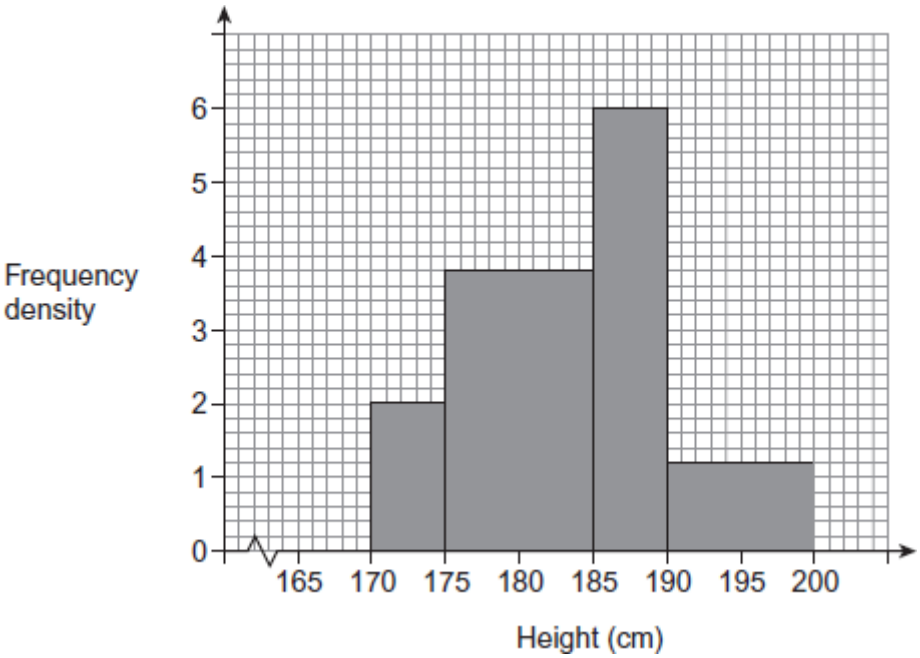
Work out the number of members with ages in the range 25 ≤ age < 40

Answer _____

(Total 4 marks)

Q8.

The histogram represents the heights of 90 firefighters.



(a) Which of the four bars represents the greatest number of firefighters?
You **must** show your working.

_____

_____

_____

_____

Answer _____ cm ≤ height < _____ cm

(3)

(b) Calculate an estimate of the mean height.
You **must** show your working.

_____

_____

_____

_____

_____

_____

_____

Answer _____ cm

(4)

(c) The tallest firefighter was 195.6 cm
The shortest firefighter was 170.4 cm

Both heights are given to 1 decimal place.

Work out the maximum possible difference in their heights.

Answer _____ cm

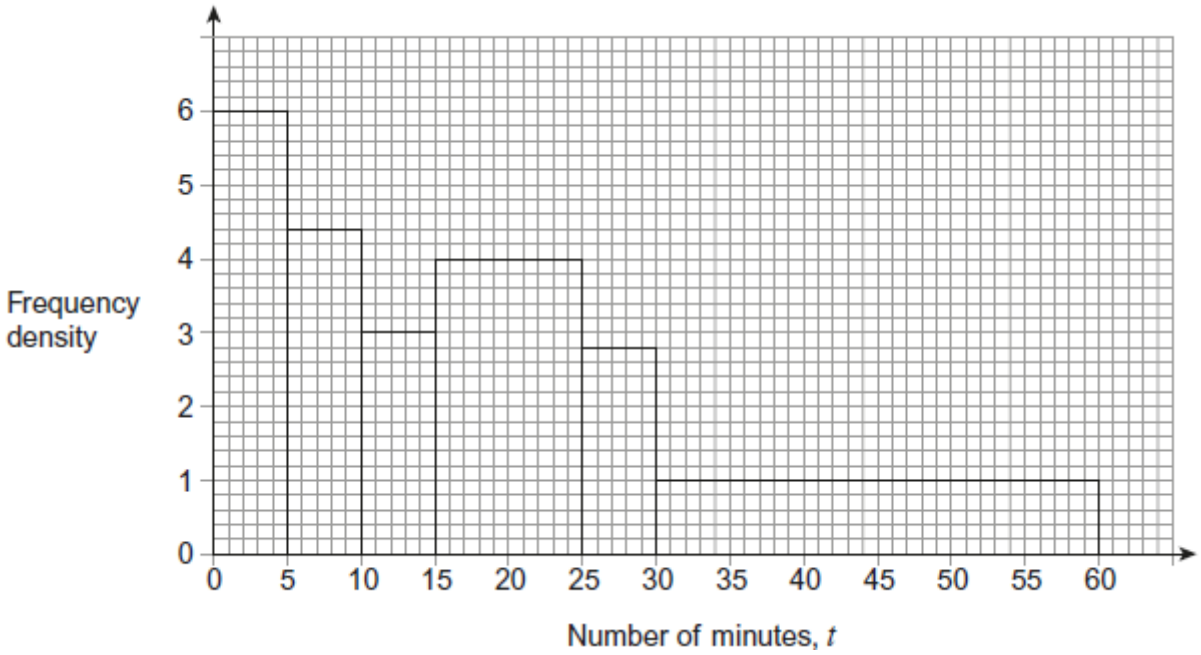
(2)

(Total 9 marks)

Q9.

A train company records the number of minutes, *t*, some trains were late in one month.

The histogram summarises the results.



(a) How many trains were **more** than 15 minutes late?

Answer _____

(3)

(b) Which is the modal class?

Circle your answer.

$0 < t \leq 5$ $15 < t \leq 25$ $25 < t \leq 30$ $30 < t \leq 60$

(1)
(Total 4 marks)

Q10.

Work out the equation of the line that

is parallel to the line $y = 5x - 3$
passes through $(-2, -4)$

_____

_____

_____

_____

Answer _____

(Total 3 marks)

Q11.

Simplify fully $(8x^3 y^5)^2$

_____

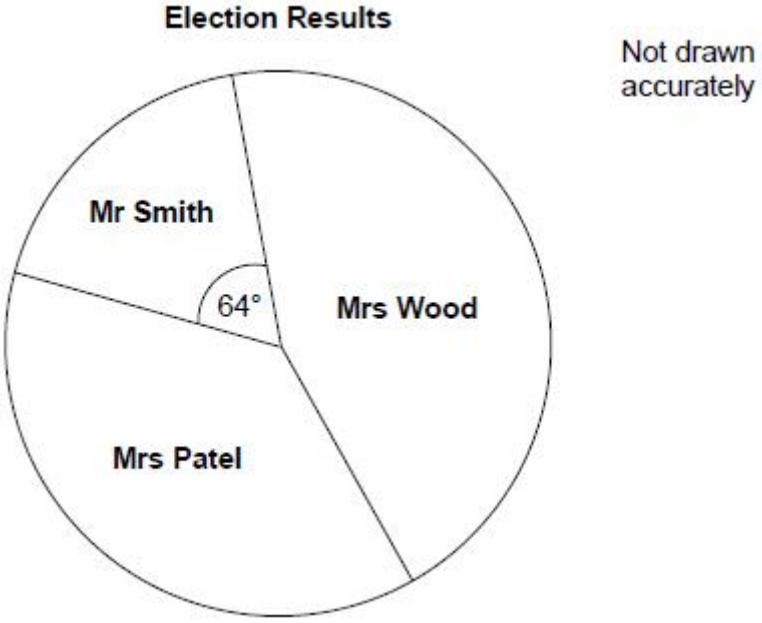
_____

Answer _____

(Total 2 marks)

Q12.

The pie chart shows some information about the share of votes for candidates in an election.



The angle for Mrs Wood would be 24° more than the angle for Mrs Patel.
There were 5220 votes in total.

Work out the number of votes for Mrs Patel.

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

(Total 4 marks)

Q13.

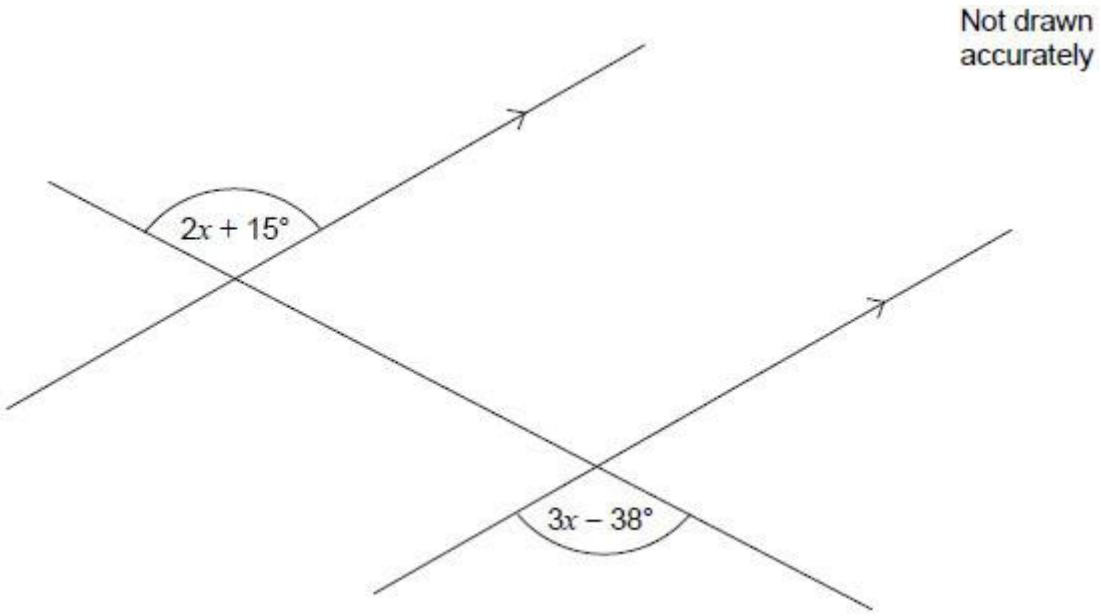
y is directly proportional to x and k is a constant.
Circle the correct equation.

$y = x + k$ $\qquad$ $y = kx$ $\qquad$ $y = \frac{k}{x}$ $\qquad$ $y = x - k$

(Total 1 mark)

Q14.

Three straight lines are shown.



Work out the value of x.

_____

_____

_____

_____

_____

Answer _____

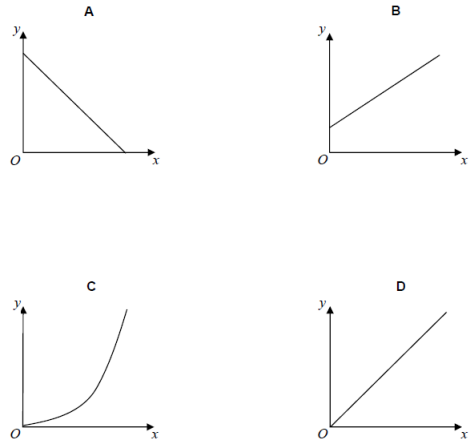
(Total 3 marks)

Q15.

y is directly proportional to x.

Which graph shows this?

Circle the correct letter.



(Total 1 mark)

Q16.

The air pressure in a tyre measures 7.2 bar.
Air is leaking out at the rate of 0.2 bar per day.

(a) Assume that the air continues to leak at the same rate.

After how many days will the pressure measure 4.8 bar?

_____

_____

Answer _____

(2)

(b) In fact, the rate that the air leaks out increases each day.

How does this affect your answer to part (a)?

_____

_____

_____

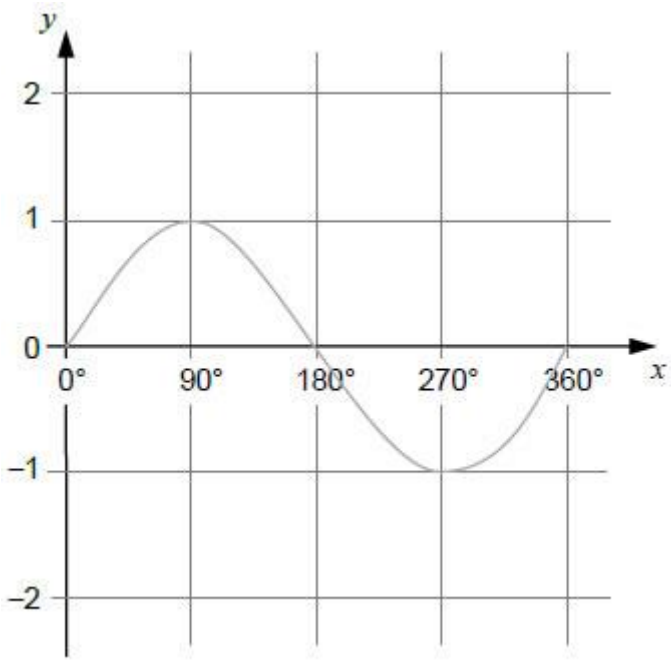
(1)

(Total 3 marks)

Q17.

(a) The graph of $y = \sin x$ is shown for $0° \leq x \leq 360°$

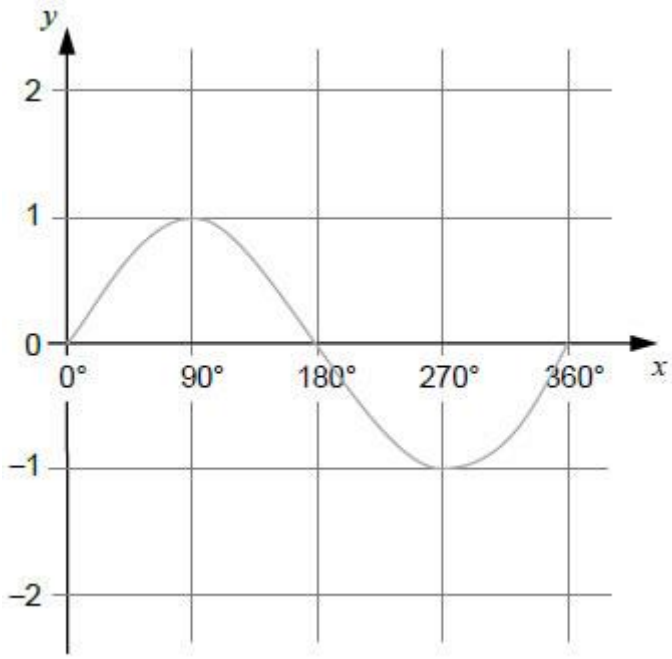
On the grid sketch the graph of $y = \sin x - 1$ $0° \leq x \leq 360°$



(1)

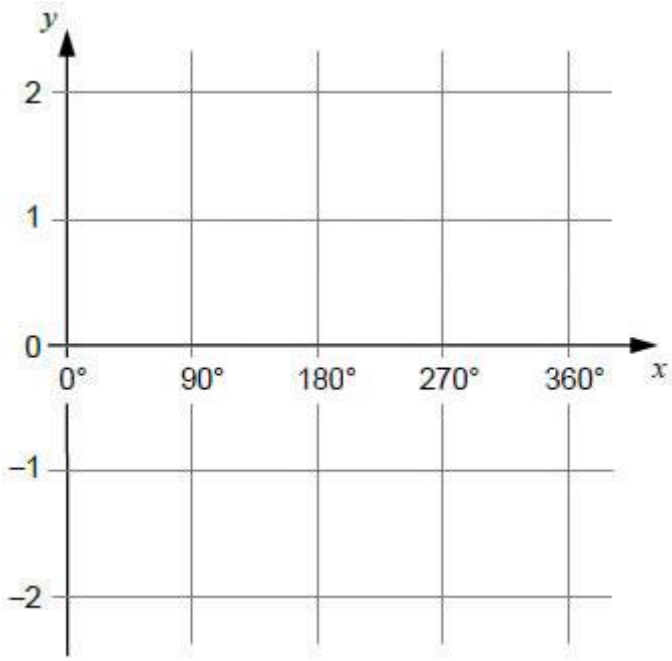
(b) The graph of $y = \sin x$ is shown on the grid for $0° \leq x \leq 360°$

On this grid sketch the graph of $y = -\sin x$ $0° \leq x \leq 360°$



(1)

(c) On this grid sketch the graph of $y = \tan x$ $0° \leq x \leq 360°$



(1)
(Total 3 marks)

Q18. (a) Work out the Highest Common Factor (HCF) of 24 and 42

_____

_____

Answer _____

(2)

(b) As a product of prime factors $36 = 2^2 \times 3^2$

Write 48 as a product of prime factors.

_____

_____

Answer _____

(2)

(Total 4 marks)

Q19.

I am thinking of a number.

My number is between 20 and 30
My number and 12 have only one common factor.

What number could I be thinking of?
Give all **three** possible answers.

_____

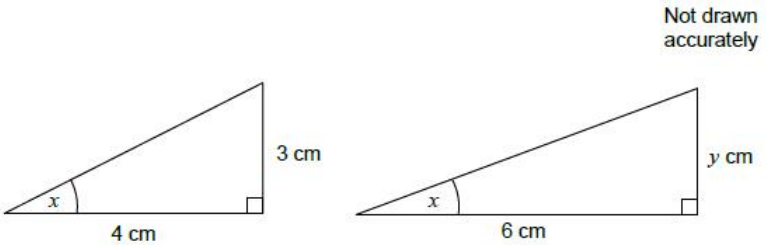
_____

_____

Answer _____ , _____ , _____

(Total 2 marks)

Q20. These two right-angled triangles are similar.



(a) Write down the value of tan x. Give your answer as a fraction.

Answer _____

(1)

(b) Work out the value of y.

_____

_____

_____

_____

Answer _____ cm

(2)

(Total 3 marks)

Q21.

Factorise $3x^2 + 14x + 8$

Answer _____

(Total 2 marks)

Q22.

On 1st January 2012 Beth invested some money in a bank account.

The account pays 2.5% compound interest per year.
On 1st January 2013 Beth withdrew £1000 from the account.
On 1st January 2014 she had £17 466 in the account.

Work out how much money Beth originally invested in the account.

Answer £.....

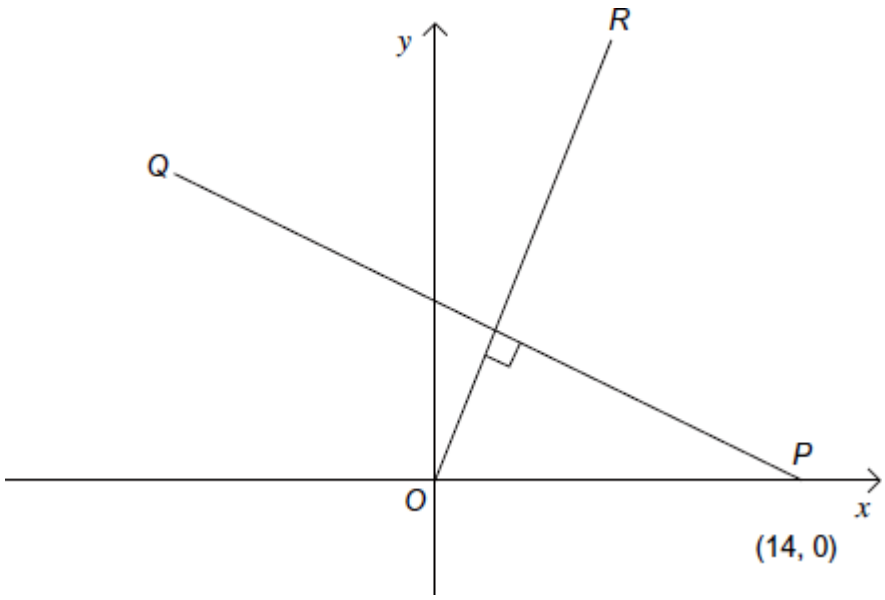
(Total 4 marks)

Q23.

The gradient of line *OR* is $\frac{7}{4}$

PQ is perpendicular to *OR*.
P is the point (14, 0).

Not drawn accurately



Work out the equation of line *PQ*.
Give your answer in the form $ax + by = c$, where a, b and c are integers.

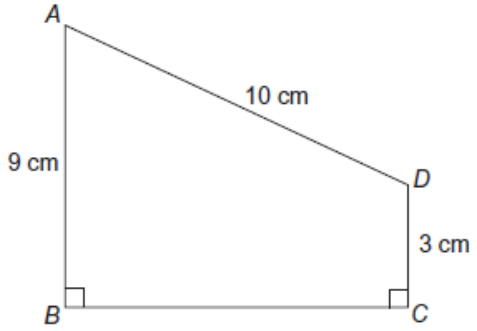
Answer _____

(Total 4 marks)

Q24.

ABCD is a trapezium.

Not drawn accurately



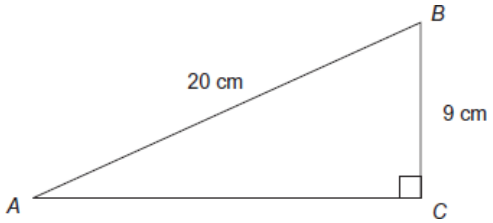
Work out the length of *BC*.
You **must** show your working.

Answer _____ cm

(Total 4 marks)

Q25.

Not drawn accurately



Work out the length *AC*.

Answer _____ cm

(Total 3 marks)

Q26. Use a ruler and a pair of compasses in this question. Construct the perpendicular bisector of *AB*.

(Total 2 marks)

Q27. The times that 80 customers waited at a supermarket checkout are shown.

Time, *t* (minutes)	**Frequency**
$0 \leq t < 2$	32
$2 \leq t < 4$	19
$4 \leq t < 6$	20
$6 \leq t < 8$	7
$8 \leq t < 10$	2

(a) In which class interval is the median?

Circle your answer.

$0 \leq t < 2$ $\quad$ $2 \leq t < 4$ $\quad$ $4 \leq t < 6$ $\quad$ $6 \leq t < 8$

(1)

(b) The manager of the supermarket says,

"90% of our customers wait less than 6 minutes."

Does the data support this statement?
You **must** show your working.

_____

_____

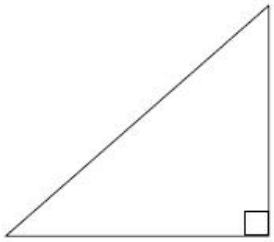
_____

Answer _____

(1)

(Total 2 marks)

Q28. The area of a **right-angled**, **isosceles** triangle is 4 cm^2



Not drawn accurately

Work out the perimeter of the triangle in centimetres.
Give your answer in the form $a + b\sqrt{c}$, where a, b and c are integers.

Answer _____ cm

(Total 4 marks)

Q29. These expressions represent four numbers. The value of the median of the expressions is 12.

x $\quad$ $2x$ $\quad$ $6x$ $\quad$ $11x$

Work out the value of the mean of the expressions.

Answer _____

(Total 5 marks)

Q30.

80 patients gave information about how long they waited to see the doctor.

Time, T, (minutes)	Frequency		
$0 \leq T < 10$	5		
$10 \leq T < 20$	22		
$20 \leq T < 30$	28		
$30 \leq T < 40$	21		
$40 \leq T < 50$	4		

(a) Work out an estimate of the mean time that the patients waited.

_____

_____

_____

Answer _____ minutes

(4)

(b) The doctor says, "70% of our patients wait less than 30 minutes to be seen."

Is she correct? You **must** show your working.

_____

_____

_____

Answer _____

(3)

(Total 7 marks)

Q31. Expand and simplify $(2x + 5)(2x - 5)(3x + 7)$

_____

_____

_____

_____

_____

_____

Answer _____

(Total 3 mark)

Q32. (a) Write down four **different** numbers that have

a **median** of 5
and a **range** of 7

Put the numbers in order.

_____

_____

Answer _____ , _____ , _____ , _____

(2)

(b) The table shows the scores of 20 students in a test.

Score	**Frequency**
7	6
8	9
9	4
10	1
Total	20

Work out the mean score.

_____

_____

Answer _____

(3)

(Total 5 marks)

Q33. $2x + 3y = 15.5$

$x + y = 6$ Work out the values of x and y.

_____

_____

_____

_____

x = _____

y = _____

(Total 3 marks)

Q34. Here is some information about the number of books read by a group of people in 2014

One of the frequencies is missing.

Number of books	Frequency	Midpoint	
0 – 4	16	2	
5 – 9		7	
10 – 14	20	12	
15 – 19	10	17	

Midpoints are used to work out an estimate for the mean number of books read.

The answer is 8.5

Work out the missing frequency.

Answer _____

(Total 5 marks)

Q35.

Solve the equation $\frac{6}{x+3} + \frac{1}{2x+5} = 3$

Give your answers to 2 decimal places.

Answer _____ and _____

(Total 6 marks)

Mark schemes

Q1.

Alternative method 1

1.2 or 0.85

M1

1 ÷ 0.85 or 1.1(7...) or 1.18

M1

1.1(7...) or 1.18 and 1.2 and (Option) A

A1

Alternative method 2

1.2 or 0.85

M1

1 ÷ 1.2 or 0.83(...)

M1

0.83(...) and 0.85 and (Option) A

A1

Alternative method 3

450 × 1.2 or 540
or
x × 0.85 or 0.85x

x is the usual cost of the box and may be a numerical value

M1

x ÷ their 540 or their 0.85x ÷ 450

M1dep

0.00185(...)x and 0.00188(...)x and (Option) A

oe

A1

Alternative method 4

450 × 1.2 or 540
or
x × 0.85 or 0.85x

x is the usual cost of the box and may be a numerical value

M1

their 540 ÷ x or 450 ÷ their 0.85x

M1dep

$\frac{540}{x}$ and $\frac{529.(...)}{x}$ and (Option) A

oe

A1

Alternative method 5

$\frac{1}{6}$ (free for A)

oe fraction or decimal or percentage

M1

$\frac{3}{18}$ (free for A) and $\frac{3}{20}$ (free for B)

oe pairs of fractions or pairs of decimal or pairs of percentages

M1

$\frac{3}{18}$ (free for A) and $\frac{3}{20}$ (free for B) and (Option) A

A1

[3 marks]

Q2.

70 × 40 or 2800

(Nisha)

M1

their 2800 − $\frac{5}{100}$ × their 2800

or 2800 − 140 or 2660

oe

(Nisha)

M1dep

70 ÷ 5 or $\frac{1}{5}$ × 70 or 14

or $\frac{4}{5}$ × 70 or 56

oe

(Dipen)

M1

their 14 × 4 × 40 or 56 × 40

or 70 × 40 − their 14 × 40

or their 2800 − their 14 × 40

or 2240

oe

dependent on 3rd method mark

(Dipen)

M1dep

2660 and 2240

A1

420 and No

Strand (iii)

correct comparison for their values, with at least one correct

value

Q1ft

Additional Guidance

2800 − 140 implies minimum **first** and **second** Method marks

2800 − 560 implies minimum **third** and **fourth** Method marks

[6]

Q3.

(a) $30x^3y^7$

B1 for two correct terms

B2

Additional Guidance

Do not ignore fw for B2

$30 \times x^3 \times y^7$

B1

$30 \times x^3y^7$

B1

$x^3y^7 30$

B1

$7x^3 \times 4y^7$

B1

Do not allow addition sign,

eg $10x^3 + 3y^7$

B0

(b) $x^2 - 3x + 7x - 21$

Allow one error

M1

$x^2 + 4x - 21$

A1

Additional Guidance

Do not ignore fw unless attempting to solve the equation

$x^2 - 3x - 21$ or $x^2 + 7x - 21$ (one error)

M1A0

$x^2 - 21$ (two errors)

M0A0

$x^2 - 4x - 21$ with no other working (two errors)

M0A0

(c) 8 and –2

or $x = 8$ and $x = -2$

Any order

B1

(d) $2xy\ (4x + 3y)$

B1 for a correct partial factorisation

$x\ (8xy + 6y^2)$

$y\ (8x^2 + 6xy)$

$2\ (4x^2y + 3xy2)$

$2x\ (4xy + 3y^2)$

$2y\ (4x^2 + 3xy)$

$xy\ (8x + 6y)$

B2

[7]

Q4.

$4x + 2x + 90 = 180$

oe

60 and/or 30 in correct place on diagram

M1

$4x + 2x = 180 - 90$

or $6x = 90$

or $4x = 60$

or $2x = 30$

oe

Collecting terms

M1dep

15

A1

[3]

Q5.

$7x - 3 = 3x + 3$

B1

$7x - 3x = 3 + 3$

or $4x = 6$

oe isolating x and number terms

M1

$x = 1.5$

A1

7.5 or $7\frac{1}{2}$

ft 7 × their 1.5 − 3

or 3(their 1.5 + 1)

B1ft

[4]

Q6.

$\frac{4x+2}{6}$ or $\frac{15x-6}{6}$

oe

M1

$\frac{4x+2}{6} + \frac{15x-6}{6} = \frac{19x-4}{6}$

A1

[2]

Q7.

Alternative method 1

25 × 11 or 275

M1

their 275 ÷ 22 or 12.5

M1dep

15 × 30 ÷ their 12.5

M1

36

A1

Alternative method 2

25 × 11 or 275

M1

15 × 30 ÷ their 275 or [1.6, 1.64]

M1dep

their [1.6, 1.64] × 22

M1

36

A1

Alternative method 3

11 squares
or
275 squares

M1

22 ÷ 11 or 2
or
22 ÷ 275 or 0.08

M1dep

their 2 × 18
or
their 0.08 × 450

M1

36

A1

Alternative method 4

$\frac{15}{25}$ or $\frac{30}{11}$

M1

$\frac{15}{25} \times \frac{30}{11}$ or $\frac{18}{11}$

oe fraction

M1dep

their $\frac{18}{11} \times 22$

M1

36

A1

Alternative method 5

$25 \times h = 22$ or $\frac{22}{25}$ or 0.88

oe

M1

$0.88 \div 11$ or 0.08

oe eg frequency density axis labelled with correct scale

M1dep

their $0.08 \times 30 \times 15$

M1

36

A1

[4 marks]

Q8.

(a) (175 – 170) × 2 or 10 (firefighters)

or (185 – 175) × 3.8

or (190 – 185) × 6

or (200 – 190) × 1.2 or 12

M1

38 or 30

A1

175 ≤ height < 185 and 38 seen

Working needed

SC1 for 175 ≤ height < 185 without relevant working

Condone 175 – 185 or 185 – 175

A1

Alternative method

170 to 175 = 2 or = 50

or 190 to 200 = 2.4 or = 60

Counts squares

M1

7.6 or 6

or

190 (firefighters) or 150

Must be from counting squares

A1

175 ≤ height < 185 and 190 seen

or

175 ≤ height < 185 and 7.6 seen

Working needed

SC1 for 175 ≤ height < 185 without relevant working

Condone 175 – 185 or 185 – 175

A1

Additional Guidance

Ignore a slip in calculating the end bar(s) if middle correct

(b) Midpoints seen or implied

172.5, 180, 187.5, 195

Condone one error

B1

their $\sum fx$

10 × 172.5 + 38 × 180 + 30 × 187.5 + 12 × 195

or 1725 + 6840 + 5625 + 2340

or 16 530

Condone one error

ft their midpoints

M1

their $\sum fx \div 90$

their 16 530 ÷ 90

M1 dep

184 or 183.7 or 183.66... or 183.67

Anything less accurate than 2dp requires correct working seen

NB Using heights gives 183.69 and scores B1 only

A1

Alternative method

Midpoints seen or implied

172.5, 180, 187.5, 195

Condone one error

B1

their $\sum fx$

2 × 172.5 + 7.6 × 180 + 6 × 187.5 + 2.4 × 195

or 345 + 1368 + 1125 + 468

or 3306

Condone one error

ft their midpoints

M1

their $\sum fx \div 18$

their 3306 ÷ 18

M1 dep

184 or 183.7 or 183.66... or 183.67

Anything less accurate than 2dp requires correct working seen

NB Using heights gives 183.69 and scores B1 only

A1

Additional Guidance

A repeated consistent error is only one error

(c) One correct bound seen

170.35 or 170.45 or

195.55 or 195.65

195.6 − 170.4 + 0.1

M1

25.3

A1

[9]

Q9.

(a) 10 × 4 or 40
or 5 × 2.8 or 14
or 30 × 1 or 30

M1

40 + 14 + 30

Allow one error

M1dep

84

A1

Additional Guidance

Beware of 30 from an incorrect method,
eg 10 ÷ 4 = 2.5, 5 ÷ 2.8 = 1.78(…), 30 ÷ 1 = 30, 30 from wrong working

M0

or 6 × 5 = 30 (first bar)

M0

(b) $15 < t \leq 25$

B1

[4]

Q10.

Gradient is 5

Implied by $y = 5x$...

B1

their $5 \times -2 + c = -4$

M1

$y = 5x + 6$ or $5x - y + 6 = 0$
or $y - 5x - 6 = 0$

ft their gradient

A1 ft

[3]

Q11.

$64x^6y^{10}$

B1 for two terms correct

B2

[2]

Q12.

Alternative method 1

$64 + x + x + 24 = 360$

oe

M1

$2x = 360 - 24 - 64$

or $x = 136$

M1

their $\frac{136}{360} \times 5220$

oe

M1

1972

A1

Alternative method 2

$360 - 64$ or 296

M1

$\frac{296 - 24}{2}$ or 136

oe

M1

their $\frac{136}{360}$ x 5220

oe

M1

1972

A1

[4]

Q13.

$y = kx$

B1

[1]

Q14.

$3x - 38 = 2x + 15$

oe

M1

$3x - 2x = 15 + 38$

Collects terms oe

M1dep

53

A1

[3]

Q15.

D

B1

[1]

Q16.

(a) **Alternative method 1**

7.2 − 4.8 or 2.4

M1

12

A1

Alternative method 2

7.2 − at least eight 0.2s
or 4.8 + at least eight 0.2s

M1

12

A1

Alternative method 3

7.2 ÷ 0.2 or 36
and 4.8 ÷ 0.2 or 24

M1

12

A1

(b) It will take fewer days

oe the answer would be lower

eg it will be less than 12

B1

Additional Guidance

Quicker/faster than 12 days

B1

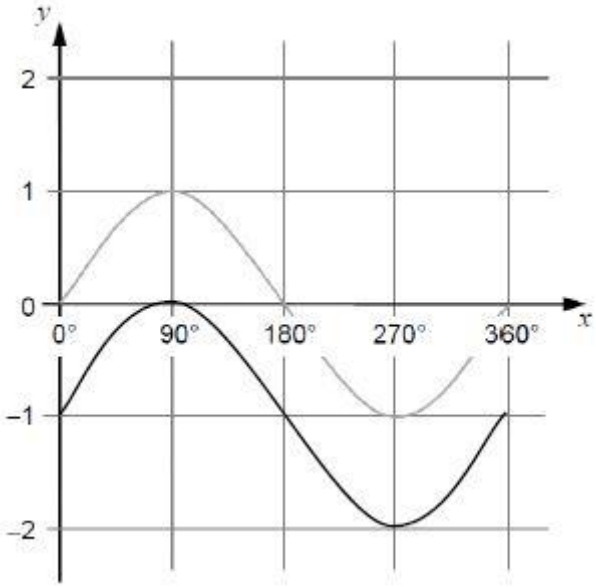
Quicker/faster alone

B0

[3]

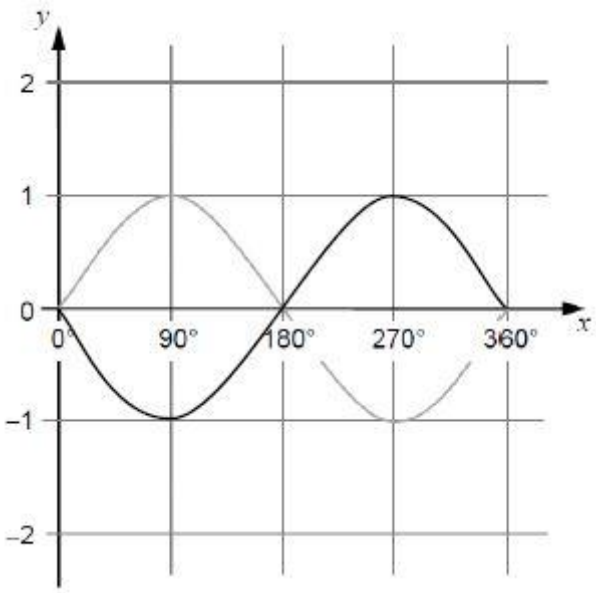
Q17.

(a) Correct graph drawn



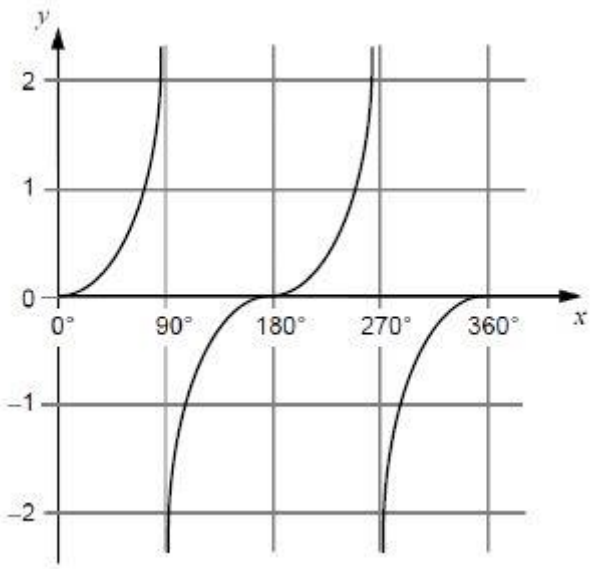
B1

(b) Correct graph drawn



B1

(c) Correct graph drawn



B1

[3]

Q18.

(a) 6

B1 for answer of 2 or 3 or 2 × 3

B1 for 24 = {2, 2, 2, 3} or 2 × 2 × 2 × 3

or 42 = {2, 3, 7} or 2 × 3 × 7

or

one pair of factors of 24

(not 1 × 24) eg 2 × 12, 3 and 8, 24 ÷ 4 = 6 (oe)

***and** one pair of factors of 42 (not 1 × 42)*

eg 2 × 21, 3 / 14, (6, 7) (oe)

or (24 =) {1, 2, 3, 4, 6, 8, 12, 24}

or (42 =) {1, 2, 3, 6, 7, 14, 21, 42}

B2

(b) 48 as a correct product
(except 1 × 48)

eg

2 × 24 or 3 × 16 or 6 × 8 or
2 × 3 × 8 or (2, 24) or (1, 2, 3, 8) etc

oe eg 48 ÷ 2 = 24 or branches on a prime factor tree showing at least one product or factor ladder showing a correct division

Ignore incorrect products if at least one correct product seen

M1

$2 \times 2 \times 2 \times 2 \times 3$ or $2^4 \times 3$ (1)
or $2^3 \times 2 \times 3$(1) or $2^2 \times 2^2 \times 3$(1)

A1

[4]

Q19.

23, 25 and 29

any order

B1 three correct and one incorrect

or two correct and none or one incorrect

SC1

any three or all four of 21, 22, 26 and 27 with no other number

B2

[2]

Q20.

(a) $\frac{3}{4}$

oe

B1

(b) **Alternative method 1**

6 ÷ 4 or 1.5 or 4 ÷ 6 or $\frac{2}{3}$
or
4 ÷ 3 or $\frac{4}{3}$ or 3 ÷ 4 or $\frac{3}{4}$

oe

M1

4.5

A1

Alternative method 2

$\frac{y}{6}$ = their $\frac{3}{4}$

oe

M1

4.5

ft their tan x from (a)

A1ft

Alternative method 3

$\tan^{-1}$ (their $\frac{3}{4}$) or [36.8, 36.9]

This could be on the diagram or seen in part (a)

M1

4.5

ft their tan x from (a)

A1ft

Additional Guidance

For M1, accept $\frac{2}{3}$ or $\frac{4}{3}$ given as a decimal truncated or rounded to 2dp or better
Award both marks for an answer of 8 in part (b) unless an incorrect statement is made; eg

M0A0

in (a), tan x = $\frac{4}{3}$, in (b), $\frac{3}{4}$ = $\frac{y}{6}$, answer 4.5

M1A1

in (a), tan x = $\frac{4}{3}$, in (b), tan x = $\frac{6}{y}$ (incorrect), $\frac{4}{3}$ = $\frac{6}{y}$, answer 4.5

M0A0

in (a), tan x = $\frac{4}{3}$, in (b), tan x = $\frac{y}{6}$, $\frac{4}{3}$ = $\frac{y}{6}$, answer 8

M1A1ft

If the answer line is blank, but 4.5 is seen correctly embedded or as the correct length on the diagram, award only the method mark

M1A0

In alt 2 and alt 3 their tan x must be a value for tan x and not a value for x

[3]

Q21.

$(3x + a)(x + b)$
where $ab = 8$ or $a + 3b = 14$
or
$3x(x + 4) + 2(x + 4)$
or
$x(3x + 2) + 4(3x + 2)$

M1

$(3x + 2)(x + 4)$

oe

A1

[2]

Q22.

Alternative method 1

17 466 ÷ 1.025 or 17 040

M1

their 17 040 + 1000 or 18 040

M1dep

their 18 040 ÷ 1.025

M1

17 600

SC2 11 978(.25)

A1

Alternative method 2

1.025x − 1000

oe

M1

their (1.025x − 1000) × 1.025
= 17 466

oe

M1dep

1.025 × 1.025 x =
17 466 + 1.025 × 1000
or
1.050625x = 18 491

oe

M1

17 600

SC2 11 978(.25)

A1

[4]

Q23.

(Gradient of PQ =) $\frac{-4}{7}$

Allow 0.57 or better for $\frac{4}{7}$

B1

0 = $\frac{-4}{7}$ × 14 + K

(K =) 14 × their $\frac{4}{7}$ *or* $-14 \times$ *their* $\frac{-4}{7}$ *(= 8)*

8 marked at the y-intercept

ft non-integer gradient

M1

$y = \frac{-4}{7}x + 8$

ft non-integer gradient

A1ft

$4x + 7y = 56$

oe

ft their equation with a non-integer coefficient of x and M1 awarded

A1ft

[4]

Q24.

Alternative method 1

6 stated or shown on diagram as length from *A* to intersection of *AB* and horizontal line from *D*.

Maybe on diagram

B1

10^2 – their 6^2 or 64 or $(BC)^2 + 6^2 = 10^2$

their 6 is the length from A to intersection of AB and horizontal line from D.

10^2 + their 6^2 or 136

M1dep

√their 64

64 must come from 10^2 – their 6^2

M1dep

8

8 with no working M0

A1

Alternative method 2

6 stated or shown on diagram as length from *A* to intersection of *AB* and horizontal line from *D*.

Maybe on diagram

B1

3, 4, 5 Pythagorean triple shown

M1

6, 8 shown or stated

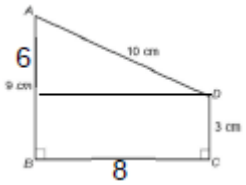
M1dep

8

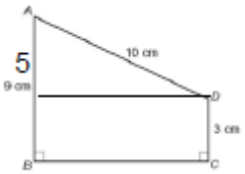
8 with no working M0

A1

Additional Guidance



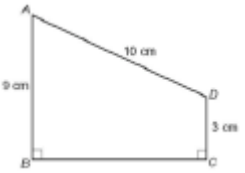
Minimum for 4 marks



$10^2 - 5^2 = 75$

$\sqrt{75} \approx 8.5$

B0,
M1
M1dep
A0

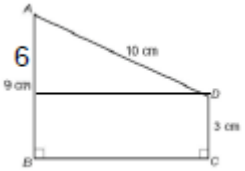


$10^2 - 5^2 = 75$

$\sqrt{75} \approx 8.5$

B0
M0

Use of cos rule. If left with cos 90 M0



$10^2 = x^2 + 6^2 - 2 \times 6 \times x \times \cos 90$

B1
M0

[4]

Q25.

20^2 and 9^2

or 400 and 81

or 319

oe

M1

$\sqrt{20^2 - 9^2}$

or $\sqrt{400 - 81}$

or $\sqrt{319}$

M1dep

17.86… or 17.9

Accept 18 if working shown

A1

[3]

Q26.

A pair of intersecting arcs of equal radii from ends of line with two intersections

oe

M1

Perpendicular line drawn through points of intersection

1 mm tolerance

A1

[2]

Q27.

(a) $2 \leq t < 4$

(b) **Alternative method 1**

B1

32 + 19 + 20 or 71 and 80 × 0.9
or
(32 + 19 + 20) ÷ 80 × 100 or 88.75

oe

M1

71 and 72 and No
or
88(.75)(%) or 89(%) and No

Accept 88(.75)(%) and Yes because it rounds to 90

A1

Alternative method 2

7 + 2 or 9 and 80 × 0.1
or
(7 + 2) ÷ 80 × 100 or 11.25

oe

M1

9 and 8 and No
or
11(.25)(%) or 12(%) and No

A1

[3]

Q28.

$\frac{1}{2}x^2 = 4$ or $x^2 = 8$

oe any letter

May be implied

M1

$\sqrt{4 \times 2}$ or $\sqrt{8}$

or $2\sqrt{2}$ or 2.8(28…) or 2.83

M1

(hypotenuse =)

$\sqrt{(\sqrt{\text{their } 8})^2 + (\sqrt{\text{their } 8})^2}$

or $\sqrt{8+8}$ or $\sqrt{16}$ or 4

M1

$4 + 2\sqrt{8}$ or $4 + 4\sqrt{2}$

or $4 + (1)\sqrt{32}$

A1

Additional Guidance

Condone $\pm\sqrt{8}$ and $\pm\sqrt{16}$ etc for 2nd and/or 3rd M1

[4]

Q29.

(Median =) $\frac{2x+6x}{2}$

or $4x$ (= 12) seen

oe

M1

$x = 3$

oe

A1

3, 6, 18 and 33 seen

or their 3 + 2(their 3) + 6(their 3) + 11(their 3)

or their 3, 6, 18 and 33 seen

or (Mean =) $\frac{x+2x+6x+11x}{4}$

Allow one error

M1

$\frac{3+6+18+33}{4}$ or $\frac{20x}{4}$ or $5x$

or their $5x$

or (their 3 + 2(their 3) + 6(their 3) + 11(their 3)) ÷ 4

M1dep

15

ft 5 × their x value

A1ft

[5]

Q30.

(a) Midpoints seen or implied
5, 15, 25, 35, 45

B1

their $\sum fx$

This mark is for the sum of their midpoints × frequencies but condone one error

5 × 5 + 15 × 22 + 25 × 28 + 35 × 21 + 45 × 4

or 25 + 330 + 700 + 735 + 180

or 1970

5 × 5 = 25
15 × 22 = 330
25 × 28 = 700
35 × 21 = 735
45 × 4 = 180

M1

their $\sum fx \div 80$

their 1970 ÷ 80

M1dep

24.6(…)

Accept 25 with working shown

A1

(b) 5 + 22 + 28 or 55

21 + 4 or 25

M1

$\frac{5+22+28}{80} \times 100$

$\frac{21+4}{80} \times 100$

M1

68(…)(%) or 69 and No

31.(…)(%) and no

A1

Alternative Method

5 + 22 + 28 or 55

21 + 4 or 25

M1

$\frac{70}{100} \times 80$ or 56

$\frac{30}{100} \times 80$ or 24

M1

55 and 56 and No

or 56 is in the 30 − 40 group so No

24 and 25 and No

A1

[7]

Q31.

$4x^2 - 10x + 10x - 25$
or $4x^2 - 25$
or $6x^2 + 14x - 15x - 35$
or $6x^2 - x - 35$
or $6x^2 + 14x + 15x + 35$
or $6x^2 + 29x + 35$

Allow one error

M1

$4x^2 - 10x + 10x - 25$
or $4x^2 - 25$
or $6x^2 + 14x - 15x - 35$
or $6x^2 - x - 35$
or $6x^2 + 14x + 15x + 35$
or $6x^2 + 29x + 35$

Fully correct

A1

$12x^3 + 28x^2 - 75x - 175$

A1

[3]

Q32.

(a) Four different numbers in any order with median 5 and range 7 eg

1, 4, 6, 8

9, 6, 4, 2

3, 10, 6, 4

1, 3, 7, 8

2, 3, 7, 9

0, 4, 6, 7

1.5, 4, 6, 8.5

−1, 4.5, 5.5, 6

B1 Four numbers in any order with median 5 and range 7 with repeats eg

4, 4, 6, 11
3, 3, 7, 10
1, 5, 5, 8
5, 5, 4, 11
5, 5, 5, 12

*B1 Four **different** numbers in any order with median 5 **or** range 7*

B2

(b) 7 × 6 or 42 or

8 × 9 or 72 or

9 × 4 or 36 or

10 × 1

or 160

At least one product shown or one correct value (not 10)

M1

(their 42 + their 72 + their 36 + their 10) ÷ 20

Must have the sum of 4 products divided by 20
Condone missing brackets
(7 × 6 + 8 × 9 + 9 × 4 + 10 (× 1)) ÷ 20 is M2

M1 dep

8

A1

[5]

Q33.

($2x + 3y = 15.5$) ($2x + 3y = 15.5$)
$2x + 2y = 12$ $3x + 3y = 18$

Equates coefficients

M1

$y = 3.5$
or $x = 2.5$

oe

A1

$x = 2.5$ and $y = 3.5$

A1

[3]

Q34.

16 × 2 or 32 or
7 × x or 7x or
20 × 12 or 240 or
10 × 17 or 170 or
16 + x + 20 + 10 or 46 + x

oe

M1

16 × 2 + 7 × x + 20 × 12 + 10 × 17
or
16 × 2 + 7x + 240 + 170 or
442 + 7x

oe
Must be the sum of 4 products
Award if correct expression seen, even if in an incorrect equation

M1

their $(32 + 7x + 240 + 170) =$
$8.5 \times$ their $(16 + x + 20 + 10)$
or
their $(442 + 7x) =$
$8.5 \times$ their $(46 + x)$

oe equation

ft their sum of at least 3 products, one of which must be $7 \times x$

ft sum of at least 3 frequencies, one of which must be x

M1

their $442 –$ their $(8.5 \times 46) =$
$8.5x – 7x$

oe equation

dep on 3rd M1

Expands and rearranges their equation

Allow one sign or expansion error

M1dep

34

Answer 34 with no incorrect working gains 5 marks

A1

[5]

Q35.

$6(2x + 5) + 1(x + 3)$ or $3(x + 3)(2x + 5)$

oe

May be seen as part of a fraction or fractions with denominator $(x + 3)(2x + 5)$

M1

$6(2x + 5) + 1(x + 3) = 3(x + 3)(2x + 5)$

oe

M1dep

$6x^2 + 20x + 12 (= 0)$
or
$3x^2 + 10x + 6 (= 0)$

Simplifying the expression to three terms

A1

$$\frac{-20 \pm \sqrt{20^2 - 4 \times 6 \times 12}}{2 \times 6}$$

$$\text{or } \frac{-10 \pm \sqrt{10^2 - 4 \times 3 \times 6}}{2 \times 3}$$

oe

Allow one error

–2.548... or –0.784...

Strictly ft their quadratic

M1

$$\frac{-20 \pm \sqrt{20^2 - 4 \times 6 \times 12}}{2 \times 6}$$

or $$\frac{-10 \pm \sqrt{10^2 - 4 \times 3 \times 6}}{2 \times 3}$$

oe

fully correct

A1ft

–0.78 and –2.55

A1

Additional Guidance

One correct solution to 2 or more dp implies 4 marks

Two correct solutions to more than 2 dp implies 5 marks

$3x^2 + 10x = -6$

M1M1A1

ft their quadratic for the 4th and 5th marks

If no real roots M1A1ft can still be awarded

If quadratic factorises, must see correct factors for M1 and correct solutions for A1ft

If quadratic does not factorise, attempt to factorise scores M0

"Their quadratic" must be in the form $ax^2 + bx + c$ (= 0) or equivalent, no credit for solving a quadratic embedded within fractions etc

[6]