

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Ratio, Proportion and Rates of Change

Calculating with speed

v1.0

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. e.g. accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
3.14...	Allow answers which begin 3.14 e.g. 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q1.

- (a) $180 - 125$ or 55

M1

$125 \div 50$

or 2.5 or 2h 30 minutes

oe

M1

their $55 \div 60$ or $11/12$ h or 55 min

Dependent on 1st M1 or subtracting 25 from their distance

oe

M1dep

3 hours and 25 minutes

205 mins

A1

- (b) (The journey will) take longer

oe

B1

Additional Guidance

More time

B1

(The journey will) be slower

B0

[5]

Q2.

- (a) $48 \div 8$ or 6 or 0.625

oe

M1

“their $48 \div 8$ ” $\times 5$

or 6×5

or 48×0.625

oe

M1dep

30

A1

- (b) Their $30 \div 20$

M1

1.5 (hours) or 90 (minutes)

Ft from their answer to (a)

Allow answer in minutes or hours without units stated. If units are given, they must be correct

A1ft

[5]

Q3.

- (a) $30 \div 40$ ($\times 60$) or 45 min or $\frac{3}{4}$
or
 $45 \div 50$ ($\times 60$) or 54 min or $\frac{9}{10}$ h
or
 $50 \div 60$ ($\times 60$) or 50 min or $\frac{5}{6}$ h oe

M1

Two of

- $30 \div 40$ ($\times 60$) or 45 min or $\frac{3}{4}$ h
and/or
 $45 \div 50$ ($\times 60$) or 54 min or $\frac{9}{10}$ h
and/or
 $50 \div 60$ ($\times 60$) or 50 min or $\frac{5}{6}$ h oe

M1

- $30 \div 40$ ($\times 60$) or 45 min or $\frac{3}{4}$ h
and
 $45 \div 50$ ($\times 60$) or 54 min or $\frac{9}{10}$ h
and
 $50 \div 60$ ($\times 60$) or 50 min or $\frac{5}{6}$ h oe

M1

(Route) 2 with all working correct oe

A1

Additional Guidance

Condone missing units, but note that 50 is given as both a distance and a speed in the question

- (b) Time = 36 minutes or $\frac{3}{5}$ h
or 18 minutes difference
or scale factor $\frac{5}{3}$
oe

B1

$45 \times \frac{5}{3}$ or $45 \div \frac{3}{5}$
or 75

M1

25 mph faster

A1

Additional Guidance

25 mph with no box ticked

B1M1A0

25 mph with slower ticked

B1M1A0

[7]

Q4.

- (a) $88 + 92 (+18)$
or $180 (+18)$
or 198

M1

$$88 + 92 (+18) - 64$$

$$\text{or } 180 - 64 (+18)$$

$$\text{or } 198 - 64 \text{ oe}$$

$$64 + x - 18 = 88 + 92 \text{ oe}$$

M1dep

134

SC1 for 98

A1

- (b) $180 - 125$ or 55

M1

$$125 \div 50$$

$$\text{or } 2.5 \text{ or } 2 \text{ h } 30 \text{ minutes}$$

$$\text{oe}$$

M1

their $55 \div 60$ or $11/12$ h or 55min

Dependent on 1st M1 or subtracting 125 from their distance
oe

M1dep

3 hours and 25 min
205 mins

A1

- (c) (The journey will) take longer
oe

B1

Additional Guidance

More time

B1

(The journey will) be slower

B0

[8]

Q5.

$$(\text{Total time}) = \frac{30}{a} + \frac{30}{b}$$

$$\text{oe eg } \frac{30b}{ab} + \frac{30a}{ab} \text{ or } \frac{30(b+a)}{ab}$$

M1

correct expression for total distance

$$\text{eg } (30 + 30) \div \left(\frac{30}{a} + \frac{30}{b} \right)$$

$$\text{or } 60 \div \frac{30(b+a)}{ab} \text{ or } 60 \times \frac{ab}{30(b+a)}$$

M1dep

$$60 \times \frac{ab}{30(a+b)} = \frac{2ab}{a+b}$$

condone $b + a$ for $a + b$
condone $30a + 30b$ for $30(a + b)$

A1

Additional Guidance

Students can gain M1M1 if they incorrectly simplify a correct expression for total time before forming the division

eg $\frac{30}{a} + \frac{30}{b} = \frac{60}{a+b}$ followed by $60 \div \frac{60}{a+b}$

M1M1A0

Allow correct cancellation of 60 and 30 at any stage of the working

[3]

Q6.

(P:) (D =) $90T$

or (M:) (D =) $70(T + 1)$
oe

M1

$$90T = 70(T + 1)$$

Condone missing bracket, ie $90T = 70T + 1$ but no further marks unless bracket recovered,

M1dep

$$90T - 70T = 70$$

oe **NB** $70 \div 20$ is M3

M1dep

$$3.5$$

oe 3.30 is M3, A0

A1

Alternative Method 1

Chooses a value for distance travelled and correctly works out time taken at 90kph **and** time taken at 70kph

*Lists distance travelled for Paul and Mary (for at least 2 hours)
Eg 90, 180, 270, 360, ...
70, 140, 210, 280, 350,*

M1

Subtracts their values or repeats above with a different value

Trying a new value implies that the difference between previously calculated times was not 1.

M1dep

Chooses a different value for distance travels and correctly works out time taken at 90kph **and** time taken at 70kph, but the difference in times must be closer to 1 hour than the previous choice.

oe

M1dep

$$3.5$$

oe 3.30 is M3, A0 SC2 315 km

A1

Alternative Method 2(P:) (D =) $90(t - 1)$ or (M:) (D =) $70t$

NB this scheme is for working out the time that Mary takes. It can be 'recovered' for full marks but if it ends at 4.5 then 2 marks maximum.

oe**M1** $20t = 90$, and $t = 4.5$ **NB** $90 \div 20 = 4.5$ is M2**M1dep**Their $4.5 - 1$ **oe****M1dep**

3.5

oe 3.30 is M3, A0**A1****[4]****Q7.**

(a) $\frac{140}{50} = 4\frac{1}{2}$ 4.5 or 4.50 or 4 h 30m

B1 each

Do not accept 4.30

B3

(b) Indication that car X passes start at 15, 30, 45, 60 mins
or Indication that car Y passes start at 20, 40, 60 mins
or 15 for X and 20 for Y

NB time in hours can score M1 ie $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ etc
 $\frac{1}{4}$ for X and $\frac{1}{3}$ for Y

M1

60

Answer of 1 hour is M1, A0

A1**Additional Guidance**

60 from wrong work is zero marks but 60 from no work or no incorrect work is full marks

[5]

Q8.

1(h) 20 (min) and 50 (min)

or

$1\frac{20}{60}$ (h) or $1\frac{1}{3}$ (h) or 1.33...(h)

or $\frac{50}{60}$ (h) or $\frac{5}{6}$ (h) or 0.83...(h)

oe

Journey time(s) at 10.20 am

B1

6 × their $1\frac{1}{3}$ or 8

oe Priya's distance at 10.20 am

M1

their 8 ÷ their $\frac{50}{60}$ or 9.6
or 16.8 ÷ 8 or 2.1

oe Joe's speed in km/h

Multiplier for distance comparison

M1dep

16.8 ÷ their 9.6 or 1.75(h)

or 1(h) 45 (min) or 105 (min)

oe

Joe's total journey time

or 16.8 ÷ 8 × 50 ÷ 60)

or

$\frac{16.8 - \text{their } 8}{\text{their } 9.6}$ or $\frac{8.8}{\text{their } 9.6}$

or 0.91(6...)(h) or 0.917(h)

or 0.92(h) or 55(min)

Joe's journey time after overtaking Priya

M1dep

11.15 (am)

oe eg quarter past 11 (in the morning)

A1

Additional Guidance

If 11.15 comes from correct method but with premature rounding

eg $8 \div 0.83 = 9.64$

$16.8 \div 9.64 = 1.743$ h

$1.743 \times 60 = 104.58$ minutes

ie 11 : 14 : 58 so 11 : 15

B1M3A0

8 km implies

B1M1

16.8 ÷ 6 or 2.8 with no further valid working

B0M0

[5]

Q9.

15 minutes or $\frac{1}{4}$ hour oe

52 (miles)

B1

B1

[2]

Q10.

Alternative method 1

$60 \div 5$ or 12

or

$3.5 \div 5$ or 0.7

oe

M1

their 12×3.5

or

their 0.7×60

oe

M1dep

42

A1

Alternative method 2

7 (miles) in 10 (minutes)

or 10.5 (miles) in 15 (minutes)

or 14 (miles) in 20 (minutes)

or 21 (miles) in 30 (minutes)

or 35 (miles) in 50 (minutes)

M1

7×6

or 10.5×4

or 14×3

or 21×2

or $35 \div 3.5 \times 2$

oe

M1dep

42

A1

Alternative method 3

$5 \div 60$ or 0.08(3...)

oe

M1

$3.5 \div$ their 0.08(3...)

oe

M1dep

42

Accept [42, 42.2]

A1

Additional Guidance

$\frac{5}{60}$ or $\frac{1}{12}$ is oe 0.08(3...)

M1

[3]

Q11.

Alternative method 1

$110 \div 2$ or 55

or

$2 \div 110$ or 0.018(1...) or 0.0182

or

$44 \div 110$ or 0.4

or

$110 \div 44$ or 2.5

oe

M1

$44 \div (110 \div 2)$ or 0.8 or $\frac{4}{5}$

oe eg 2880

or calculation that would evaluate to 0.8

eg $2 \div 110 \times 44$

or

$44 \div 110 \times 2$

or

$2 \div (110 \div 44)$

or

$\frac{110 + 44}{110 \div 2} - 2$ or $2.8 - 2$

M1dep

48

A1

Alternative method 2

$110 \div 2 \div 60$

or 0.916... or 0.917 or 0.92

or

$2 \times 60 \div 110$

or 1.09(0...) or 1.091

oe

M1

$44 \div (110 \div 2 \div 60)$

oe calculation that would evaluate to 48

eg $44 \times 2 \times 60 \div 110$

M1dep

48

A1

Additional Guidance

Ignore units for M marks eg 55 miles

M1

Do not award A1 if premature approximation for 48 seen

eg

(Alt 1) $0.018 \times 44 = 0.8$ Answer 48

M2A1

(Alt 1) $0.018 \times 44 = 0.792$ and $0.792 \times 60 = 47.52$ Answer 48

M2A0

(Alt 2) $44 \div 0.917 = 48$

M2A1

(Alt 2) $44 \div 0.917 = 47.9$ Answer 48

M2A0

(Alt 2) $44 \times 1.09 = 48$

M2A1

(Alt 2) $44 \times 1.09 = 47.96$ Answer 48

M2A0

48 followed by answer 2 h 48 min

M2A0

48 followed by answer 168 min

M2A0

Allow M1 even if not subsequently used

Alt 1 Working in seconds leading to 2880

M2

[3]

Q12.

Alternative method 1

$18 \div 36$ or 0.5 or 30

oe

implied by 3.5 or 3 h 30 min or 3.3(0) or 210 seen

M1

$$\frac{200 - 18}{4 - \text{their } 0.5} \text{ or } \frac{182}{3.5}$$

or

$$\frac{200 - 18}{4 \times 60 - \text{their } 30} \text{ or } \frac{182}{210}$$

or 0.86(6...) or 0.87

oe method for miles per hour or miles per minute

$$\text{implied by } \frac{182}{3 \text{ h } 30 \text{ min}} \text{ or } \frac{182}{3.3(0)}$$

M1dep

52

A1

Alternative method 2

18 ÷ 36 or 0.5 or 30

*implied by 7***M1**

$$\frac{200}{4} + \frac{50-36}{7}$$

*or 50 + 2**oe***M1dep**

52

A1**Additional Guidance**

Allow the first mark even if not subsequently used

Ignore units for the M marks

Answer 0.86(6...) or 0.87

M1M1A0

Answer 0.86(6...) or 0.87 with mph crossed out and replaced by miles per min oe

M1M1A1Working for 52 then $(52 + 36) \div 2$ **M1M1A0**NB $50 + 2 = 52$ from $200 \div 4 = 50$ and $36 \div 18 = 2$ **Zero****[3]****Q13.**

(a) 46

B1(b) 1.5 seen or implied
or 14 seen*oe***B1**28 × 1.5
or 28 + 14*Attempt to multiply speed by time*
eg 28 × 1.3 or 36.4
or 90 × 28 or 2520
*or 130 × 28 or 3640***M1**

42

A1**[4]****Q14.**(a) their 9×0.6
or their $9 \div 0.5$
or $0.6 \div 0.5 (= 1.2)$
*oe***M1**

$$\frac{\text{their } 9 \times 0.6}{0.5}$$

*oe***M1dep**

10.8

A1

(b) 13.6×3600
or $13.6 \div 1000$
or $3600 \div 1000$
oe
 50×1000
or $50 \div 3600$
or $1000 \div 3600$

M1

$$\begin{array}{r} 13.6 \times 3600 \\ \hline 1000 \end{array} \quad \begin{array}{r} 50 \times 1000 \\ \hline 3600 \end{array}$$

M1

48(...) or 49
 $13.8(\dots)$ or 13.9

A1

Alternative Method

13.6×3600
 $13.6 \div 1000$

M1

50×1000
 $50 \div 3600$

M1

48 960 or 49 000 and 50 000
 0.0136 and $0.0138(\dots)$ or 0.0139

A1

[6]

Q15.

$169 \div 65$
 65×2.5 or $65 \times \text{their } 2.5$ or $169 \div 2.5$

M1

2.6 or 2 hours 36 (minutes)
 162.5 or 6.5 miles to go or 67.6 (mph)

A1

2h 30 or 2.5 h or 150 (minutes)
or
9.06 or 9.1 (not 9.10)
or
6.24 or 6.4
 $2.5h$

B1

No

A1

[4]

Q16.

Alternative method 1

$$2 \times \pi \times 40$$

or [251.2, 251.5]

or 251

or 250

M1

$$(2 \times \pi \times 40 + 200)$$

or [251.2, 251.5] + 200

or 251 + 200

or 250 + 200

M1dep

Distance $\div$ 18 or Distance $\div$ 30

M1

25.(...) and yes

or 15.(...) and yes

*Strand (iii) decision to match their answers
ft provided M1M0M1*

Q1ft

Alternative method 2

$$2 \times \pi \times 40$$

or [251.2, 251.5]

or 251

or 250

M1

$$(2 \times \pi \times 40 + 200)$$

or [251.2, 251.5] + 200

or 251 + 200

or 250 + 200

M1dep

18 $\times$ 30 or 540

M1

[450, 451.5] and 540 and yes

*Strand (iii) decision to match their answers
ft provided M1M0M1*

Q1ft

Additional Guidance

$$100 + 100 + 40 + 40 = 280, 280 \div 18 = 15.(\dots)$$

M0M0M1Q0

$$\pi \times 80 = 251.3, 251.3 \div 2 = 125.65$$

M0

Distance means any number using addition of lengths given in the question

e.g. (100 + 40), 250, 200, 100

[4]

Q17.

- (a) 1 hour 40 minutes
 or 100 (minutes)
 or 1.66... (hours) seen
 oe
 eg 1:40

B1

$$450 \div 1.66(\dots) \text{ or } 450 \div 1.67$$

$$\text{or } 450 \div 1\frac{2}{3}$$

their distance $\div$ their time

M1

$$270$$

A1

- (b) Faster

B1

Valid reason

eg
Travels further (distance)
More distance (so faster)

B1dep**[5]****Q18.**

- (a) **Alternative method 1**
 $27\,576 \times 24$ or $661\,824$

M1

$$\text{their } 661\,824 \div 42\,600 \text{ or } 15.5\dots$$

M1

$$15$$

A1

Alternative method 2

$$42\,600 \div 27\,576 \text{ or } 1.54\dots$$

M1

$$24 \div \text{their } 1.54\dots \text{ or } 15.5\dots$$

M1

$$15$$

A1

Alternative method 3

$$27\,576 \div 42\,600 \text{ or } 0.647\dots$$

M1

$$\text{their } 0.647 \times 24 \text{ or } 15.5\dots$$

M1

$$15$$

A1

(b) **Alternative method 1**

$27\,576 \div 60 \div 60$ or 7.66

M1

their 7.66×1000

M1dep

7660

A1

Alternative method 2

$27\,576 \times 1000$ or 27 576 000

M1

their $27\,576\,000 \div 60 \div 60$

M1dep

7660

A1

Alternative method 3

$1000 \div (60 \times 60)$ or 0.277... or 0.28

M1

their $0.277... \times 27\,576$

M1dep

7660

A1

[6]

Q19.

- (a) 1 hour 30 minutes
or 90 (minutes)
or 1.5 (hours) seen
oe
eg 1:30

B1

$690 \div 1.5$

their distance $\div$ their time

M1

460

A1

- (b) Faster

B1

Valid reason

eg
Travels further (distance)
More distance (so faster)

B1dep

[5]

Q20.

- (a) 1 hour 30 minutes
or 90 (minutes)
or 1.5 (hours) seen
oe
eg 1:30

B1

$$450 \div 1.5$$

their distance $\div$ their time

M1

$$300$$

A1

- (b) Faster

B1

Valid reason

eg
Travels further (distance)
More distance (so faster)

B1dep

[5]

Q21.

$$176 \div 48$$

or $3.66\ldots$ or 3.67 or $\frac{11}{3}$
or 3 h 40 mins

*oe eg 220 mins
implied by 12 40 pm*

M1

$$(293 - 176) \div 65$$

or $117 \div 65$ or 1.8 or $\frac{9}{5}$
or 1 h 48 mins

oe eg 108 mins

M1

their $3.66\ldots$ + their 1.8 or $\frac{82}{15}$
or [5.46, 5.47]

or

5 h 28 mins

or

[2 27 (pm), 2 28.2 (pm)]

*oe eg 328 mins
dep on M2
implied by adding times
eg 9 + 3 40 + 1 48*

M1dep

5.5 and [5.46, 5.47] and Yes

or

5 h 30 mins and 5 h 28 mins and Yes

or

330 mins and 328 mins and Yes

or

[2 27 (pm), 2 28.2 (pm)] and Yes

*oe arrival time
must be in a comparable time format*

A1

Additional Guidance

Up to M3 may be awarded for correct work seen in multiple attempts even if not subsequently used

Accept use of 24 hour clock throughout

Do not accept 2 28 am as a correct arrival time

$$\frac{176}{48} = 3.6, \frac{117}{65} = 1.8, 3.6 + 1.8 = 5.4, 2\ 24\ \text{pm and Yes}$$

M1M1M1A0

$$\frac{176}{48} = 3.7, \frac{117}{65} = 1.8, 3.7 + 1.8 = 5.5, 2\ 30\ \text{pm and Arrives on time}$$

M1M1M1A0

$$3.6 + 1.8 = 5.4, 2\ 24\ \text{pm and Yes}$$

M0M1M0A0

$$3.7 + 1.8 = 5.5, 2\ 30\ \text{pm and Arrives on time}$$

M0M1M0A0

[4]

Q22.

$$3 \times 45 \text{ or } 135 \text{ or } 63$$

may be seen embedded in an expression, equation or calculation eg $3 \times 45 + 31.5x = 198$

M1

$$\frac{198 - 3 \times 45}{31.5}$$

$$\text{or } (198 - 135) \div 31.5$$

$$\text{or } 63 \div 31.5 \text{ or } 2 \text{ (hours)}$$

$$\text{oe eg } 31.5 \times 2 = 63$$

implied by total of 5 (hours)

M1dep

$$198 \div (3 + \text{their } 2) \text{ or } 198 \div 5$$

M1dep

$$39.6$$

accept 40 with M3 awarded

A1

Additional Guidance

Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

$$\text{NB } 31.5 \div (45 \div 3) = 2 \text{ (hours)}$$

M0M0

[4]

Q23.

$$0.5 \times \pi \times 45$$

$$\text{or } 0.5 \times [141, 141.4]$$

$$\text{or } [70.5, 70.7]$$

$$\text{or } 0.5 \times \pi \times 45 + 75$$

$$\text{or } [145.5, 145.7]$$

$$\text{oe eg } 22.5\pi$$

M1

$$(0.5 \times \pi \times 45 + 75) \div 18$$

or

$$\text{their } [145.5, 145.7] \div 18$$

oe

their [145.5, 145.7] can be any value

M1

$$8.08(\dots) \text{ or } 8.09(\dots)$$

may be implied by 8.1

A1

$$8.1$$

ft any answer seen with greater than 2 sf

$$\text{SC2 } 3.9$$

B1ft

Additional Guidance

Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts, B1ft may also be awarded

$$\frac{120}{18}$$

$$= 6.67 \text{ answer } 6.7$$

M0M1A0B1ft

$$\frac{120}{18}$$

$$= 6.7$$

M0M1A0B0ft

$$0.5 \times \pi \times 45 \text{ and } 70.7 \div 18 = 3.93 \text{ answer } 3.9$$

M1M1A0B1ft

SC2 for an answer of 3.9 without working is when 75 is not used

[4]

Q24.

- (a) Draws a tangent at $t = 6$

B1

change in speed

change in time for their tangent

M1

Correct answer for their tangent

A1ft

- (b) Attempts to work out area below straight lines

$$\text{eg } 4 \times 12 \text{ or } 48 \text{ and } \frac{1}{2} \times 6 \times 12 \text{ or } 36$$

M1

Attempts to work out estimate of area under the curve

$$\text{eg } \frac{1}{2} \times 14 \times 12 \text{ or } 84$$

$$\frac{1}{2} \times 14 \times (4 + 12) \text{ or } 112$$

M1

their total distance $\div 24$

M1

Their answer worked out correctly with no errors in area below straight lines

Their area must be in the range [168, 196]

A1

- (c) Correct box ticked with suitable comment

ft their answer to part (b)

eg their (b) 168

Underestimate ticked and triangle less than area under curve their (b) 196

Overestimate ticked and trapezium more than area under curve

B1ft

[8]

Q25.

$$\frac{240}{x-12} \text{ or } \frac{240}{x}$$

$$x-12 = \frac{240}{t+1} \text{ or } x = \frac{240}{t}$$

M1

$$\frac{240}{x-12} \text{ and } \frac{240}{x}$$

$$x-12 = \frac{240}{t+1} \text{ and } x = \frac{240}{t}$$

M1dep

$$\frac{240}{x-12} - \frac{240}{x} = 1$$

$$\frac{240}{t} - 12 = \frac{240}{t+1}$$

M1dep

$$240x - 240(x-12) = x(x-12)$$

$$240(t+1) - 12t(t+1) = 240t$$

$$\text{or } 2880 = x^2 - 12x$$

$$\text{or } t^2 + t - 20 = 0$$

$$\text{or } x^2 - 12x - 2880 = 0 \text{ oe}$$

M1 dep

$$(x+48)(x-60)$$

$$(t+5)(t-4)$$

or correct use of formula

or correct use of formula

$$\frac{-12 \pm \sqrt{12^2 - 4(1)(-2880)}}{2(1)}$$

$$\frac{-1 \pm \sqrt{1^2 - 4(1)(-20)}}{2(1)}$$

$$\text{or } (x-6)^2 - 36 - 2880 = 0$$

M1

60

SC2 for 60 from trial and error

A1

[6]

Q26.

$$247 - 170 \text{ or } 77$$

oe
may be on diagram

M1

$$23 \times 1\frac{1}{2} \text{ or } 34.5$$

oe eg $23 + 11.5$ or $23 \times 90 \div 60$
or 23×1.5
may be on diagram

M1

$$(\text{their } 34.5)^2 + 60^2 - 2 \times \text{their } 34.5 \times 60 \times \cos(\text{their } 77)$$

or [3858, 3859]

oe
dep on at least one M scored

M1dep

$$\sqrt{\text{their } [3858, 3859]} \text{ or } 62.1(\dots)$$

oe
eg $\sqrt{34.5^2 + 60^2 - 2 \times 34.5 \times 60 \times \cos 77}$
dep on 3rd M1

M1dep

No and 62.1(...)

oe eg 62.1 and the ship is further away
accept No and 62 with M4 scored

A1

Additional Guidance

Up to M2 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts

2nd M1 Do not accept 23×1.30 unless recovered

[5]