



# Mark Scheme (Results)

## Summer 2026

Pearson Edexcel International GCSE Mathematics A  
4MA1/1H

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## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme.

Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.

- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

- **Types of mark**

- M marks: method marks
- A marks: accuracy marks
- B marks: unconditional accuracy marks (independent of M marks)

- **Abbreviations**

- cao – correct answer only
- ft – follow through
- isw – ignore subsequent working
- SC – special case
- oe – or equivalent (and appropriate)
- dep – dependent
- indep – independent
- awrt – answer which rounds to
- eeoo – each error or omission

- **No working**

If no working is shown then correct answers normally score full marks  
If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **With working**

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If it is clear from the working that the “correct” answer has been obtained from incorrect working, award 0 marks.

If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review. If there is a choice of methods shown, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.

If there is no answer on the answer line then check the working for an obvious answer.

- **Ignoring subsequent work**

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**

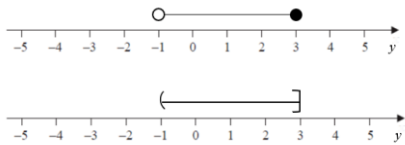
Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded to another.

| Question | Working                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Answer                         | Mark | Notes                                                                                                                                                                                                                                                                         |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b> | $\frac{29}{7}(-)\frac{13}{5}$ <b>or</b><br>$(4)\frac{5}{35}(-)(2)\frac{21}{35}$ <b>oe or</b> $(4)\frac{5a}{35a}(-)(2)\frac{21a}{35a}$ <b>oe</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                | 3    | M1 for correct improper fractions<br><b>or</b><br>fractional part of numbers written correctly over a common denominator                                                                                                                                                      |
|          | eg<br>$\frac{145}{35} - \frac{91}{35}$ <b>or</b> $\frac{29 \times 5}{7 \times 5} - \frac{13 \times 7}{5 \times 7}$ <b>or</b> $\frac{29 \times 5 - 13 \times 7}{5 \times 7}$ <b>or</b><br>$\frac{145a}{35a} - \frac{91a}{35a}$ <b>or</b> $4\frac{5}{35} - 2\frac{21}{35} = 2\frac{-16}{35}$ <b>oe or</b><br>$2 + \frac{5}{35} - \frac{21}{35} = 2 - \frac{16}{35}$ <b>oe or</b> $3\frac{40}{35} - 2\frac{21}{35}$                                                                                                                                                                                                                        |                                |      | M1 for correct fractions with a common denominator with subtraction sign present<br><b>or</b><br>for working with mixed numbers to the stage shown<br><br>implies the first M1                                                                                                |
|          | eg<br>$\frac{145}{35} - \frac{91}{35} = \frac{54}{35} = 1\frac{19}{35}$ <b>or</b> $4\frac{5}{35} - 2\frac{21}{35} = 2\frac{-16}{35} = 1\frac{19}{35}$ <b>or</b><br>$4\frac{5}{35} - 2\frac{21}{35} = 3\frac{40}{35} - 2\frac{21}{35} = 1\frac{19}{35}$<br>If common denominator is not 35 then cancelling must be shown eg<br>$\frac{290}{70} - \frac{182}{70} = \frac{108}{70} = \frac{54}{35} = 1\frac{19}{35}$ <b>oe or</b><br>$\frac{290}{70} - \frac{182}{70} = \frac{108}{70} = 1\frac{38}{70} = 1\frac{19}{35}$ <b>oe or</b><br>$4\frac{10}{70} - 2\frac{42}{70} = 2\frac{-32}{70} = 2\frac{-16}{35} = 1\frac{19}{35}$ <b>oe</b> | A fully correct solution shown |      | A1 dep on M2 for a correct answer from fully correct working<br>If a student shows that $1\frac{19}{35} = \frac{54}{35}$ <b>and</b> has working that shows $LHS = \frac{54}{35}$ this can gain full marks<br><br><b>NB: use of decimals scores no marks unless as a check</b> |
|          | <i>Working required</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                |      | <b>Total 3 marks</b>                                                                                                                                                                                                                                                          |

| Question | Working                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Answer | Mark | Notes                                                                                                           |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|-----------------------------------------------------------------------------------------------------------------|
| 2        | eg $\cos 65 = \frac{x}{10}$ <b>or</b> $\tan 65 = \frac{10 \sin 65}{x}$ <b>or</b><br>$\sin(90 - 65) = \frac{x}{10}$ <b>or</b> $\frac{x}{\sin(90 - 65)} = \frac{10}{\sin 90}$ <b>or</b><br>$(x^2 =) 10^2 - (10 \sin 65)^2 (= 17.8(60...))$ <b>or</b><br>$(x^2 =) 10^2 - (9.06(307...))^2 (= 17.8(60...))$ <b>or</b><br>$(x^2 =) 10^2 + (10 \sin 65)^2 - (2 \times 10 \times 10 \sin 65 \times \cos 25) (= 17.8(60...))$ <b>or</b><br>$(x^2 =) 10^2 + 9.06^2 - (2 \times 10 \times 9.06 \times \cos 25) (= 17.8(60...))$                                        |        | 3    | M1 for a correct trigonometrical statement for $x$<br><b>or</b><br>for a correct Pythagoras statement for $x^2$ |
|          | eg $(x =) 10 \cos 65$ <b>or</b> $(x =) \frac{10 \sin 65}{\tan 65}$ <b>or</b><br>$(x =) 10 \sin(90 - 65)$ <b>or</b> $(x =) \frac{10}{\sin 90} \times \sin(90 - 65)$ <b>or</b><br>$(x =) \sqrt{10^2 - (10 \sin 65)^2} (= \sqrt{17.8(60...)})$ <b>or</b><br>$(x =) \sqrt{10^2 - (9.06(307...))^2} (= \sqrt{17.8(60...)})$ <b>or</b><br>$(x =) \sqrt{10^2 + (10 \sin 65)^2 - (2 \times 10 \times 10 \sin 65 \times \cos 25)} (= \sqrt{17.8(60...)})$ <b>or</b><br>$(x =) \sqrt{10^2 + 9.06^2 - (2 \times 10 \times 9.06 \times \cos 25)} (= \sqrt{17.8(60...)})$ |        |      | M1 for correct calculation to find $x$<br>(implies the first M1)                                                |
|          | <i>Correct answer scores full marks<br/>           (unless from obvious incorrect working)</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4.23   |      | A1 accept an answer in the range 4.22 – 4.23                                                                    |
|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |        |      | <b>Total 3 marks</b>                                                                                            |

| Question |        | Working                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Answer                                                  | Mark | Notes                                                                                                                   |
|----------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|------|-------------------------------------------------------------------------------------------------------------------------|
| 3        | (a)(i) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1, 2, 4, 5,<br>10, 15                                   | 1    | B1 correct values with no omissions, additional values or repeated values, can be in any order                          |
|          | (ii)   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1, 2, 4                                                 | 1    | B1 correct values with no omissions, additional values or repeated values, can be in any order                          |
|          | (b)    | <p><b>Acceptable</b><br/> eg 2 is in both sets<br/> 5 is a prime number and a factor of 20<br/> 2 and 5 are in <math>A</math> and <math>C</math><br/> The prime numbers 2 and 5 are factors of 20<br/> Set <math>A</math> contains 2 and/or 5 which is prime<br/> <math>A \cap C = \{2, 5\}</math></p> <p><b>Not acceptable</b><br/> eg there are numbers in the list that are factors of 20 and prime<br/> <math>A</math> and <math>C</math> both have 1 in them<br/> 1, 2 and 5 are in set <math>A</math> and set <math>C</math><br/> 1 and 2 are prime and in <math>A</math><br/> There are prime numbers in <math>A</math><br/> 5 is prime<br/> 5 is prime and a multiple of 5</p> | 2 and/or 5<br>are both<br>prime and<br>factors of<br>20 | 1    | B1 for a correct statement identifying 2 and/or 5 belonging to both set $A$ (factors of 20) and set $C$ (prime numbers) |
|          |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                         |      | <b>Total 3 marks</b>                                                                                                    |

| Question |  | Working                                                                                                                                                                                                                                                                                                        | Answer | Mark | Notes                                                                                                                                                                                                                                                                                       |
|----------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4        |  | eg $\frac{60}{24}$ (= 2.5) oe <b>or</b> 150 minutes <b>or</b><br>2 hours 30 minutes <b>or</b><br>$12 \times 1.25$ (=15) oe <b>or</b> $12 \times \frac{75}{60}$ (=15) oe                                                                                                                                        |        | 4    | M1 for a method to work out the time taken to cycle 60 km in hours or minutes <b>or</b><br>for a method to work out the distance Henri runs<br>Allow use of 1.15 or 1.4 for this mark                                                                                                       |
|          |  | eg $\frac{60}{24}$ (= 2.5) oe <b>or</b> 150 minutes <b>or</b><br>2 hours 30 minutes<br><b>AND</b><br>$12 \times 1.25$ (=15) oe <b>or</b> $12 \times \frac{75}{60}$ (=15) oe<br><b>OR</b><br>eg $\frac{60}{24}$ (= 2.5) oe <b>or</b> 150 minutes <b>or</b><br>2 hours 30 minutes<br><b>AND</b> 2:1 oe or 1:2 oe |        |      | M1 for a method to work out the time taken to cycle 60 km in hours or minutes <b>and</b> the distance Henri runs<br>Allow use of 1.15 or 1.4 for this mark<br><b>OR</b><br>for a method to work out the time taken to cycle 60 km in hours and minutes <b>and</b> the ratio of times as 2:1 |
|          |  | $\frac{60 + "15"}{"2.5" + 1.25}$ oe <b>or</b> $\frac{75}{3.75}$ oe <b>or</b><br>$\frac{60 + "15"}{"150" + 75}$ (= 0.333...) oe <b>or</b> $\frac{75}{225}$ oe <b>or</b><br>$\frac{2 \times 24 + 12}{3}$ oe                                                                                                      |        |      | M1 for a method to find the average speed for the whole race. This may be in km/h or km/min<br>Allow use of 1.15 or 1.4 for this mark                                                                                                                                                       |
|          |  | <i>Working required</i>                                                                                                                                                                                                                                                                                        | 20     |      | A1 dep on M2 and correct use of time conversion                                                                                                                                                                                                                                             |
|          |  |                                                                                                                                                                                                                                                                                                                |        |      | <b>Total 4 marks</b>                                                                                                                                                                                                                                                                        |

| Question |     | Working                                                                                     | Answer                 | Mark | Notes                                                                                                                                                                                                                             |
|----------|-----|---------------------------------------------------------------------------------------------|------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5        | (a) |                                                                                             | $8e^2 - 12e$           | 1    | B1                                                                                                                                                                                                                                |
|          | (b) | $f^2 - 6f + 3f - 18$                                                                        |                        | 2    | M1 for any 3 terms correct <b>or</b><br>for 4 out of 4 correct terms ignoring signs <b>or</b><br>for $f^2 - 3f \dots$ <b>or</b><br>for $\dots - 3f - 18$                                                                          |
|          |     | <i>Correct answer scores full marks<br/>(unless from obvious incorrect working)</i>         | $f^2 - 3f - 18$        |      | A1                                                                                                                                                                                                                                |
|          | (c) | eg $t + 2n = ax$ <b>or</b><br>$-ax = -2n - t$ <b>or</b><br>$\frac{t}{a} = x - \frac{2n}{a}$ |                        | 2    | M1 for a correct first step                                                                                                                                                                                                       |
|          |     | <i>Correct answer scores full marks<br/>(unless from obvious incorrect working)</i>         | $x = \frac{t + 2n}{a}$ |      | A1<br>oe eg $x = \frac{t}{a} + \frac{2n}{a}$ , must see $x =$ either in working or on answer line                                                                                                                                 |
|          | (d) |          | Correct diagram        | 2    | B2 for a fully correct diagram, accept ( for an open circle and ] for a closed circle<br><br>(B1 for drawing a line from -1 to 3 <b>or</b> (indep) for an open circle or ( at -1 <b>or</b> (indep) for a closed circle or ] at 3) |
|          |     |                                                                                             |                        |      | <b>Total 7 marks</b>                                                                                                                                                                                                              |

| Question | Working | Answer           | Mark | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------|---------|------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6        |         | $64x^{15}y^{18}$ | 2    | <p>B2 for <math>64x^{15}y^{18}</math></p> <p>(B1 a single product with 2 of 64, <math>x^{15}</math>, <math>y^{18}</math> correct</p> <p>eg<br/> <math>64x^{15}y^n</math> where <math>n \neq 18</math> <b>or</b><br/> <math>64x^m y^{18}</math> where <math>m \neq 15</math> <b>or</b><br/> <math>px^{15}y^{18}</math> where <math>p \neq 64</math>.</p> <p>One term can be missing with 2 correct for B1</p> <p>eg<br/> <math>64x^{15}</math> <b>or</b> <math>64y^{18}</math> <b>or</b> <math>(4)x^{15}y^{18}</math> <b>or</b><br/> <math>ax^{15}by^{18}</math> where <math>a</math> and <math>b</math> are integers as long as not added to any other terms)</p> |
|          |         |                  |      | <b>Total 2 marks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Question | Working                                                                                                                                                                                                                                                  | Answer | Mark | Notes                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|--------------------------------------------------------------------------|
| 7        | $1 - (0.12 + 0.16) (= 0.72)$ oe <b>or</b><br>$0.12 + x + 2x + 0.16 = 1$ oe <b>or</b><br>$3x + 0.28 = 1$ oe <b>or</b><br>$0.12 \times 500 (= 60)$ oe <b>or</b><br>$0.16 \times 500 (= 80)$ oe <b>or</b><br>$(0.12 + 0.16) \times 500 (= 140)$ oe          |        | 4    | M1                                                                       |
|          | $(x =) "0.72" \div 3 (= 0.24)$ oe <b>or</b><br>$(2x =) "0.72" \div 3 \times 2 (= 0.48)$ oe <b>or</b><br>$(500 - "140") \div 3 (= 120)$ oe <b>or</b><br>$(500 - "140") \div 3 \times 2 (= 240)$ oe                                                        |        |      | M1                                                                       |
|          | $("0.24" + 0.16) \times 500$ oe <b>or</b><br>$[1 - (0.12 + "0.48")] \times 500$ oe <b>or</b><br>$("0.24" \times 500) + "80"$ oe <b>or</b><br>$500 - ["60" + "0.48" \times 500]$ oe <b>or</b><br>$"120" + "80"$ oe <b>or</b><br>$500 - ["60" + "240"]$ oe |        |      | M1<br>or for $\frac{200}{500}$ <b>or</b> $\frac{300}{500}$ <b>or</b> 300 |
|          | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                                                          | 200    |      | A1    cao                                                                |
|          |                                                                                                                                                                                                                                                          |        |      | <b>Total 4 marks</b>                                                     |

| Question |  | Working                                                                                                                                                                                                                                                                                                                                                                                                                           | Answer                  | Mark | Notes                                                                                                                                                                                       |                                                                                         |
|----------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 8        |  | $70 \div 1000 (= 0.07 \text{ or } \frac{7}{100}) \text{ oe}$<br><b>or</b> $70 \times 60 \times 60 (= 252\,000) \text{ oe}$<br><b>or</b> $\frac{60 \times 60}{1000} \text{ or } \frac{3600}{1000} \text{ or } \frac{18}{5} \text{ or } 3.6$<br><b>or</b> $\frac{1000}{60 \times 60} \text{ or } \frac{1000}{3600} \text{ or } \frac{5}{18} \text{ or } 0.27(777\dots)$<br><b>or</b> $70 \times \frac{60}{1000} (= 4.2) \text{ oe}$ |                         | 3    | M1    for one of $\div 1000$ (eg sight of 0.07)<br><b>or</b><br>( $\times 60 \times 60$ ) <b>or</b> $\times 3600 \text{ oe}$<br>ie correct conversion of distance units<br>or of time units | M2 for<br><br>$70 \times 3.6 \text{ oe}$ <b>or</b><br>$70 \div \frac{5}{18} \text{ oe}$ |
|          |  | $70 \times \frac{60 \times 60}{1000} \text{ oe}$<br>eg $(4200 \div 1000) \times 60 \text{ oe}$                                                                                                                                                                                                                                                                                                                                    |                         |      | M1    for a fully correct method                                                                                                                                                            |                                                                                         |
|          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                   | <i>Working required</i> |      | 252                                                                                                                                                                                         | A1    cao dep on M1                                                                     |
|          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |      | <b>Total 3 marks</b>                                                                                                                                                                        |                                                                                         |

| Question |     | Working                                                                                                                                                           | Answer                | Mark | Notes                |
|----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|----------------------|
| 9        | (a) |                                                                                                                                                                   | $6.51 \times 10^{-2}$ | 1    | B1                   |
|          | (b) | $32 \times 10^{56+74}$ <b>or</b> $32 \times 10^{130}$ <b>oe or</b><br>$3.2 \times 10^n$ where $n \neq 131$ <b>or</b><br>$p \times 10^{131}$ where $1 \leq p < 10$ |                       | 2    | M1                   |
|          |     | <i>Correct answer scores full marks<br/>(unless from obvious incorrect<br/>working)</i>                                                                           | $3.2 \times 10^{131}$ |      | A1                   |
|          |     |                                                                                                                                                                   |                       |      | <b>Total 3 marks</b> |

| Question | Working                                                                                                                                                                                                                                                                                               | Answer                                                                                                                                                                                                                                                                                              | Mark | Notes |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10       | <div><math display="block">\begin{array}{r} -4x + 3y = 9 \\ \text{eg } 4x - 4y = -26 \\ \hline \text{Subtracting} \\ (3y - -4y = 9 - -26 \text{ or } 7y = 35) \\ \text{or} \\ 4\left(\frac{2y-13}{2}\right) + 3y = 9 \\ \text{or} \\ 2\left(\frac{9-3y}{4}\right) - 2y = -13 \end{array}</math></div> | <div><math display="block">\begin{array}{r} +8x + 6y = 18 \\ \text{eg } 6x - 6y = -39 \\ \hline \text{Adding} \\ (8x + 6x = 18 + -39 \text{ or } 14x = -21) \\ \text{or} \\ 4x + 3\left(\frac{2x+13}{2}\right) = 9 \\ \text{or} \\ 2x - 2\left(\frac{9-4x}{3}\right) = -13 \end{array}</math></div> |      | 3     | <div>M1 for a correct method to eliminate <math>x</math> or <math>y</math>: coefficients of <math>x</math> or <math>y</math> the same <b>and</b> the correct operation to eliminate is selected; if operator not written, the correct operation can be implied by 2 out of 3 terms correct (condone any one error in multiplication)<br/><b>or</b><br/>writing <math>x</math> or <math>y</math> in terms of the other variable and correctly substituting (condone missing brackets)<br/><br/><b>NB:</b> the mark is for the method and not for the result of the method. However, if the correct result of the method is seen, the mark can be awarded</div> |
|          | <div><math display="block">\begin{array}{l} \text{eg } 4x + 3 \times "5" = 9 \\ \text{or} \\ 2x - 2 \times "5" = -13 \\ \text{or} \\ x = \frac{2 \times "5" - 13}{2} \\ \text{or} \\ x = \frac{9 - 3 \times "5"}{4} \end{array}</math></div>                                                          | <div><math display="block">\begin{array}{l} \text{eg } 4 \times " -1.5 " + 3y = 9 \\ \text{or} \\ 2 \times " -1.5 " - 2y = -13 \\ \text{or} \\ y = \frac{2 \times " -1.5 " + 13}{2} \\ \text{or} \\ y = \frac{9 - 4 \times " -1.5 "}{3} \end{array}</math></div>                                    |      |       | <div>M1 dep on M1 for a correct substitution to find the value of the second variable using their value from a correct method to find the first variable<br/><b>or</b><br/>for repeating above method to find second variable</div>                                                                                                                                                                                                                                                                                                                                                                                                                           |
|          | <i>Working required</i>                                                                                                                                                                                                                                                                               | $\begin{array}{l} x = -1.5 \\ y = 5 \end{array}$                                                                                                                                                                                                                                                    |      |       | <div>A1 dep on M1oe eg <math>-\frac{3}{2}</math></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|          |                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                     |      |       | <b>Total 3 marks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| Question |  | Working                                                                                                                                                                                                                                                                                                                                                             | Answer | Mark | Notes                                                                                                                                                                                                                                                                                                                                                                                         |
|----------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11       |  | $\frac{1}{2}\pi r^2 = 227$ oe <b>or</b> $\pi r^2 = 227 \times 2$ oe <b>or</b><br>$r^2 = 144.5...$ <b>or</b><br>$r = \sqrt{144.5...} (= 12(.02...))$                                                                                                                                                                                                                 |        | 5    | M1 for a correct equation or a correct calculation to find the radius of the semicircle                                                                                                                                                                                                                                                                                                       |
|          |  | $\frac{2\pi \times "12"}{2}$ oe <b>or</b><br>$\pi \times "12" (= 37.6(99...))$ <b>or</b><br>$\pi \times "12.02..." (= 37.7(661...))$ <b>or</b><br>$\pi \times [\text{their radius}]$                                                                                                                                                                                |        |      | M1 for a method to find the arc length of the semicircle<br>ft their value for the radius as long as clearly identified (may be on the diagram or in the working)                                                                                                                                                                                                                             |
|          |  | $\sqrt{15^2 - "12"^2} (= 9)$ <b>or</b><br>$\sqrt{15^2 - "12.02..."^2} (= 8.9(7...))$<br>$\sqrt{15^2 - [\text{their radius}]^2}$                                                                                                                                                                                                                                     |        |      | M1 for a complete method to find the height of the right angled triangle<br>ft their value for the radius as long as clearly identified (may be on the diagram or in the working)                                                                                                                                                                                                             |
|          |  | $"12"\pi + 2 \times 15 + 2 \times "9" (= 85.6(99...))$ <b>or</b><br>$"12.02..."\pi + 2 \times 15 + 2 \times "8.97..." (= 85.7(09...))$ <b>or</b><br>$"12"\pi + 48$ <b>or</b> $"12.02..."\pi + 48$ <b>or</b><br>$"37.6(99...)" + 15 + 15 + "8.97..." + "8.97..." (= 85.7(09...))$<br><b>or</b><br>$[\text{arc length}] + 2 \times 15 + 2 \times [AB \text{ or } DE]$ |        |      | M1 dep on M2 for a method to find the perimeter including at least the arc length <b>and</b> one length of 15 <b>and</b> one of <i>AB</i> or <i>DE</i><br>ft their values for the arc length and <i>AB</i> or <i>DE</i> as long as clearly identified (may be on the diagram or in working)<br>allow the error of addition of the radius ( <i>OB</i> or <i>OD</i> ) or the diameter <i>BD</i> |
|          |  | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                                                                                                                                                                     | 85.7   |      | A1 accept an answer in the range 85.6 – 85.8                                                                                                                                                                                                                                                                                                                                                  |
|          |  |                                                                                                                                                                                                                                                                                                                                                                     |        |      | <b>Total 5 marks</b>                                                                                                                                                                                                                                                                                                                                                                          |

| Question |     | Working                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                        | Answer | Mark | Notes                                                                                                                                                                        |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12       | (a) | For $2^{\frac{x}{3}}$<br>eg<br>$\left(4^{\frac{1}{2}}\right)^{\frac{x}{3}}$ <b>or</b> $4^{\frac{x}{6}}$ <b>or</b><br>$\left(8^{\frac{1}{3}}\right)^{\frac{x}{3}}$ <b>or</b> $8^{\frac{x}{9}}$ <b>or</b><br>$\left(64^{\frac{1}{6}}\right)^{\frac{x}{3}}$ <b>or</b> $64^{\frac{x}{18}}$ | For $8^x$<br>eg<br>$\left(2^3\right)^x$ <b>or</b> $2^{3x}$ <b>or</b><br>$\left(4^{\frac{3}{2}}\right)^x$ <b>or</b> $4^{\frac{3x}{2}}$ <b>or</b><br>$8^{x+2}$ <b>or</b> $8^{2+x}$ <b>or</b><br><b>or</b> $\left(64^{\frac{1}{2}}\right)^x$ <b>or</b> $64^{\frac{x}{2}}$ |        | 3    | M1 for one correct application of an index rule involving $2^{\frac{x}{3}}$ or $8^x$                                                                                         |
|          |     | eg $\frac{x}{3} - 3x = 6$ oe <b>or</b> $\frac{x}{6} - \frac{3x}{2} = 3$ oe <b>or</b><br>$\frac{x}{9} - x = 2$ oe <b>or</b> $\frac{x}{18} - \frac{x}{2} = 1$ oe <b>or</b> $x - 9x = 18$<br>oe                                                                                           |                                                                                                                                                                                                                                                                        |        |      | M1 for setting up a <b>correct</b> equation<br>This can be embedded in an index equation<br>eg $2^{\frac{x}{3}-3x} = 2^6$ (the base on the LHS and the RHS must be the same) |
|          |     | <i>Working required</i>                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                        | -2.25  |      | A1 dep on M1 oe eg $-\frac{18}{8}$ <b>or</b> $-\frac{9}{4}$ <b>or</b> $-2\frac{1}{4}$                                                                                        |

|  |     |                                                                                                                                                                                                                              |                      |   |                      |                                                                                                                                                                                                                                                                                 |                                                                                                                            |
|--|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
|  | (b) | $4t(t+5) = 4t^2 + 20t$ <b>or</b><br>$4t(2t-3) = 8t^2 - 12t$ <b>or</b><br>$(t+5)(2t-3) = 2t^2 - 3t + 10t - 15$ <b>or</b><br>$(2t^2 + 7t - 15)$                                                                                |                      | 3 | M1                   | for an expansion with <b>only one error.</b>                                                                                                                                                                                                                                    | M2 for 3 (out of a maximum of 4) of<br><br>$8t^3 - 12t^2 + 40t^2 - 60t$                                                    |
|  |     | eg<br>$(4t^2 + 20t)(2t-3) = 8t^3 - 12t^2 + 40t^2 - 60t$ or<br>$(8t^2 - 12t)(t+5) = 8t^3 + 40t^2 - 12t^2 - 60t$ or<br>$4t(2t^2 - 3t + 10t - 15) = 8t^3 - 12t^2 + 40t^2 - 60t$ or<br>$4t(2t^2 + 7t - 15) = 8t^3 + 28t^2 - 60t$ |                      |   | M1                   | ft dep on M1 and a quadratic expression multiplied by a linear expression<br><br><b>Allow one further error.</b>                                                                                                                                                                | this can be implied by<br>$8t^3 + 28t^2 \dots$ or<br>$\dots + 28t^2 - 60t$<br><br>(M1 for 2 correct out of a maximum of 4) |
|  |     | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                              | $8t^3 + 28t^2 - 60t$ |   | A1                   | cao (terms may be in any order but must be simplified) dep on M1<br><br>ISW correct factorisation<br>eg<br>$2(4t^3 + 14t^2 - 30t)$ or $4(2t^3 + 7t^2 - 15t)$<br>Do not ISW incorrect simplification or subsequent division<br>eg<br>$4t^3 + 14t^2 - 30t$ or $2t^3 + 7t^2 - 15t$ |                                                                                                                            |
|  |     |                                                                                                                                                                                                                              |                      |   | <b>Total 6 marks</b> |                                                                                                                                                                                                                                                                                 |                                                                                                                            |

| Question |     | Working                                                                                                     | Answer                               | Mark | Notes                                                                                                                                                                                                                |
|----------|-----|-------------------------------------------------------------------------------------------------------------|--------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13       | (a) |                                                                                                             | 0.15, 0.85<br>0.2, 0.8<br>0.75, 0.25 | 2    | B2 for all 3 correct pairs of probabilities on the correct branches.<br>If not B2 then award B1 for at least one correct pair of probabilities on the correct branch<br><br>NB: all values can be given as fractions |
|          | (b) | “0.15” × “0.2” oe<br><b>or</b><br>$1 - (“0.15” \times “0.8” + “0.85” \times “0.75” + “0.85” \times “0.25”)$ |                                      | 2    | M1ft ft their tree diagram provided both probabilities are < 1 for a correct method                                                                                                                                  |
|          |     | Correct answer scores full marks (unless from obvious incorrect working)                                    | 0.03                                 |      | A1 ft oe eg $\frac{3}{100}$ or 3%                                                                                                                                                                                    |
|          |     |                                                                                                             |                                      |      | <b>Total 4 marks</b>                                                                                                                                                                                                 |

| Question      | Working                                                                                                                                                                                                             | Answer | Mark | Notes                                                                                                                                                  |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14            | 1.2 <b>or</b> 0.9 <b>or</b><br>1.2 <i>n</i> <b>or</b> 0.9 <i>n</i> where <i>n</i> is a number or a variable eg 1.2 × 100 <b>or</b> 0.9 × 100 <b>or</b><br>$1.2n \times \left( \frac{100 - x}{100} \right) = 0.9n$   |        | 3    | M1 for one correct multiplier, may be seen as part of a single term or calculation or part of an equation                                              |
|               | 0.9 ÷ 1.2 (= 0.75) oe <b>or</b> 75(%)<br>$\frac{n \times 0.9}{n \times 1.2}$ where <i>n</i> is a number or variable <b>or</b><br>1 – (0.9 ÷ 1.2) (= 0.25) <b>or</b><br>$\frac{100 - x}{100} = \frac{0.9n}{1.2n}$ oe |        |      | M1 for a correct step to find the percentage decrease for October<br><b>or</b><br>for an answer of 75(%) or 0.25<br><br>this mark implies the first M1 |
|               | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                     | 25     |      | A1                                                                                                                                                     |
| Total 3 marks |                                                                                                                                                                                                                     |        |      |                                                                                                                                                        |

| Question |  | Working                                                                                                                       | Answer | Mark | Notes                                                                                                                                                                                              |
|----------|--|-------------------------------------------------------------------------------------------------------------------------------|--------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15       |  | $\frac{4 - -6}{-3 - 2} \left( = \frac{10}{-5} \right)$ oe <b>or</b><br>$\frac{-6 - 4}{2 - -3} \left( = \frac{-10}{5} \right)$ |        | 2    | M1 method to find gradient. Condone correct gradient embedded in an equation eg $y = -2x + c$ <b>or</b> an expression eg $-2x$ <b>or</b> for an answer of 2 from $10 \div 5$ or from $-10 \div -5$ |
|          |  | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                               | -2     |      | A1 cao an answer of $y = -2x - 2$ scores M1 only                                                                                                                                                   |
|          |  |                                                                                                                               |        |      | Total 2 marks                                                                                                                                                                                      |

| Question |     | Working                                                                                                                                                                                                                                                                          | Answer | Mark | Notes                                                                                                                                                                                                                                                              |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16       | (a) | $(BC^2 =) 25^2 + 73^2 - 2 \times 25 \times 73 \times \cos 65$ oe<br><b>or</b><br>$(BC =) \sqrt{25^2 + 73^2 - 2 \times 25 \times 73 \times \cos 65}$<br><b>OR</b><br>$(BN =) 25 \sin 65 (= 22.6(576...))$ oe <b>and</b><br>$(NC = AC - AN =) 73 - 25 \cos 65 (= 62.4(345...))$ oe |        | 3    | M1 for values correctly substituted into the cosine rule<br><b>OR</b><br>finding the perpendicular height of the triangle and $NC$ where $N$ is the foot of the perpendicular on $AC$<br>Allow truncated or rounded values for<br>$AN = 25 \cos 65 = 10.5(654...)$ |
|          |     | Eg<br>$25^2 + 73^2 - 1542(.556)$ <b>or</b><br>$625 + 5329 - 1542(.556)$ <b>or</b><br>$5954 - 1542(.556...)$ <b>or</b><br>$4411(.4433...)$<br><b>OR</b><br>$"22.6..."^2 + "62.4..."^2$ <b>or</b><br>$513.(37...) + 3898.(07...)$                                                  |        |      | M1 clear evidence of correct order of operations used for the cosine rule (these calculations may be square rooted)<br><br><b>OR</b><br>a correct statement for $BC^2$ using Pythagoras from finding $BN$ and $NC$                                                 |
|          |     | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                                                                                  | 66.4   |      | A1 accept an answer in the range 66.3 – 66.5                                                                                                                                                                                                                       |
|          | (b) | $\frac{1}{2} \times 25 \times 73 \times \sin 65$ oe <b>or</b><br><br>$\frac{1}{2} \times "22.6" \times 73$ oe <b>or</b><br>$\frac{1}{2} (25 \cos 65 \times 25 \sin 65) + \frac{1}{2} ((73 - 25 \cos 65) \times 25 \sin 65)$ oe <b>or</b><br>$119(.694...) + 707(.311...)$ oe     |        | 2    | M1                                                                                                                                                                                                                                                                 |
|          |     | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                                                                                  | 827    |      | A1 Accept an answer in the range 824 – 829                                                                                                                                                                                                                         |
|          |     |                                                                                                                                                                                                                                                                                  |        |      | <b>Total 5 marks</b>                                                                                                                                                                                                                                               |

| Question | Working                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Answer             | Mark | Notes                                                                                                                                                                                                                                             |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17       | $20 - 8\sqrt{5} - 5\sqrt{20} + 2\sqrt{5}\sqrt{20}$ <b>or</b><br>$20 - 8\sqrt{5} - 5\sqrt{20} + 2\sqrt{100}$ <b>or</b><br>$20 - 8\sqrt{5} - 5\sqrt{20} + 20$ <b>or</b><br>$20 - 8\sqrt{5} - 10\sqrt{5} + 20$ <b>or</b><br>$20 - 4\sqrt{20} - 5\sqrt{20} + 20$ <b>or</b><br>$(4 - 2\sqrt{5})(5 - 2\sqrt{5})$ <b>or</b><br>$\sqrt{20} = \sqrt{4}\sqrt{5}$ <b>or</b> $\sqrt{20} = 2\sqrt{5}$ <b>or</b><br>$5\sqrt{20} = 5(\sqrt{4 \times 5})$ <b>or</b> $5\sqrt{20} = 10\sqrt{5}$ |                    | 3    | M1 for expansion of brackets with 3 out of 4 terms correct or 4 terms correct ignoring signs<br><b>or</b><br>for simplifying $\sqrt{20}$ may be seen before or after expansion of brackets<br><b>or</b><br>for writing $2\sqrt{5}$ as $\sqrt{20}$ |
|          | eg $20 + 20 - 18\sqrt{5} = 40 - 18\sqrt{5}$ <b>or</b><br>$20 - 4\sqrt{20} - 5\sqrt{20} + 20 =$<br>$40 - 9\sqrt{20}$                                                                                                                                                                                                                                                                                                                                                           |                    |      | M1 dep on M1 for correct expansion of brackets <b>with</b> 3 or 4 terms shown in their expansion <b>and</b> correct simplification to two terms                                                                                                   |
|          | <i>Working required</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $40 - \sqrt{1620}$ |      | A1 (dep on M2) accept $a = 40$ $b = 1620$<br><br>SCB1 for $40 - \sqrt{1620}$ gained with no method marks awarded<br><br>SCB2 for $40 - \sqrt{1620}$ gained if you would award 1 <sup>st</sup> M1 but not 2 <sup>nd</sup> M1 (total 2 marks)       |
|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |      | <b>Total 3 marks</b>                                                                                                                                                                                                                              |

| Question |  | Working                                    | Answer             | Mark | Notes                                                                          |
|----------|--|--------------------------------------------|--------------------|------|--------------------------------------------------------------------------------|
| 18       |  | $(2x-3)(2x+3)$ <b>or</b><br>$(2x+3)(x-4)$  |                    | 3    | M1 for correct factorisation of either the numerator <b>or</b> the denominator |
|          |  | $(2x-3)(2x+3)$ <b>and</b><br>$(2x+3)(x-4)$ |                    |      | M1 for correct factorisation of the numerator <b>and</b> denominator           |
|          |  | <i>Working required</i>                    | $\frac{2x-3}{x-4}$ |      | A1 (dep on M2) fully correct factorising and cancelling<br>No ISW              |
|          |  |                                            |                    |      | <b>Total 3 marks</b>                                                           |

| Question |     | Working                                                     |                                                                                 | Answer | Mark | Notes                                                                                                                                   |                                                                                                                                                                          |
|----------|-----|-------------------------------------------------------------|---------------------------------------------------------------------------------|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19       | (a) | $M = kp^2$ oe<br>eg<br>$k = \frac{M}{p^2}$                  | $hM = p^2$ oe<br>eg<br>$h = \frac{p^2}{M}$                                      |        | 3    | M1 NB $M = p^2$ or $M \propto p^2$ on its own is not enough to score M1<br><br>Constant of proportionality must be a symbol such as $k$ | M2 for $2 = k \times 5^2$ oe<br><b>or</b><br>$2h = 5^2$ oe                                                                                                               |
|          |     | $2 = k \times 5^2$ oe<br><b>or</b><br>$k = \frac{2}{25}$ oe | $2h = 5^2$ oe<br><b>or</b><br>$h = \frac{25}{2}$ oe                             |        |      | M1 For correct substitution of $M$ and $p$ into a correct formula<br><br>Allow use of $\propto$ in place of $=$ for M marks             |                                                                                                                                                                          |
|          |     |                                                             | <i>Correct answer scores full marks (unless from obvious incorrect working)</i> |        |      | $M = \frac{2p^2}{25}$                                                                                                                   | A1 oe but must be $M =$ eg $M = 0.08p^2$<br>award 3 marks if answer is $M = kp^2$ on the answer line and $k = \frac{2}{25}$ oe is clearly seen in the body of the script |
|          | (b) |                                                             |                                                                                 | 18     | 1    | B1                                                                                                                                      | ft for their value of $k$ if $M = kp^2$ $k \neq 1$                                                                                                                       |
|          |     |                                                             |                                                                                 |        |      | Total 4 marks                                                                                                                           |                                                                                                                                                                          |

| Question      | Working                                                                                                                                                                                                                                                                  | Answer | Mark | Notes                                                                                                                                                                                                                                                                                                   |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20            | $100 - 0.5$ <b>or</b> $99.5$<br><b>or</b><br>$100 + 0.5$ <b>or</b> $100.5$<br><b>or</b><br>$1.68 - 0.005$ <b>or</b> $1.675$<br><b>or</b><br>$1.68 + 0.005$ <b>or</b> $1.685$<br><b>or</b><br>$0.5 - 0.05$ <b>or</b> $0.45$<br><b>or</b><br>$0.5 + 0.05$ <b>or</b> $0.55$ |        | 5    | B2 for all 6 correct<br>(B1 for 3, 4 or 5 correct)<br>Allow $100.4\dot{9}$ or $100.4\bar{9}$ for $100.5$<br>Allow $1.684\dot{9}$ or $1.684\bar{9}$ for $1.685$<br>Allow $0.54\dot{9}$ or $0.54\bar{9}$ for $0.55$<br><br>The value of each bound may be embedded in $v = 2\left(\frac{s}{t}\right) - u$ |
|               | $2\left(\frac{100.5}{1.675}\right) - 0.45$ <b>or</b><br>$2\left(\frac{100 + 0.5}{1.68 - 0.005}\right) - (0.5 - 0.05)$                                                                                                                                                    |        |      | M1 for correct substitution into the <i>UB</i> (=119.55)<br>$v = 2\left(\frac{s}{t}\right) - u$ where<br>$100 < s \leq 100.5$<br>$1.675 \leq t < 1.68$<br>$0.45 \leq u < 0.5$                                                                                                                           |
|               | $2\left(\frac{99.5}{1.685}\right) - 0.55$ <b>or</b><br>$2\left(\frac{100 - 0.5}{1.68 + 0.005}\right) - (0.5 + 0.05)$                                                                                                                                                     |        |      | M1 for correct substitution into the <i>LB</i> (=117.55...)<br>$v = 2\left(\frac{s}{t}\right) - u$ where<br>$99.5 \leq s < 100$<br>$1.68 < t \leq 1.685$<br>$0.5 < u \leq 0.55$                                                                                                                         |
|               | <i>Working required</i>                                                                                                                                                                                                                                                  | 120    |      | A1 dep on M2<br>120 <b>and</b> correct upper bound (119.55) <b>and</b> correct lower bound (117.55...) seen                                                                                                                                                                                             |
| Total 5 marks |                                                                                                                                                                                                                                                                          |        |      |                                                                                                                                                                                                                                                                                                         |

| Question |  | Working                                                                                                                                  | Answer  | Mark | Notes                                                                                                                                                                               |
|----------|--|------------------------------------------------------------------------------------------------------------------------------------------|---------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21       |  | $x(3x)(13.5 - 2x)$ <b>or</b> $3x^2(13.5 - 2x)$<br><b>or</b> $x(40.5x - 6x^2)$ <b>or</b><br>$3x(13.5x - 2x^2)$ <b>or</b> $40.5x^2 - 6x^3$ |         | 5    | M1 for an expression for the volume of the cuboid                                                                                                                                   |
|          |  | $\left(\frac{dV}{dx} = \right) 81x - 18x^2$                                                                                              |         |      | M1 ft for differentiating an expression to find $81x$ or $\pm 18x^2$<br>(must come from a cubic in the form $40.5x^2 \pm ax^3$ or $bx^2 \pm 6x^3$ where $a \neq 0$ and $b \neq 0$ ) |
|          |  | $81x - 18x^2 = 0$ oe                                                                                                                     |         |      | M1 ft dep on previous M1 for equating their $\frac{dV}{dx}$ to zero                                                                                                                 |
|          |  | $(x =) 4.5$                                                                                                                              |         |      | A1 oe dep on M2 for a correct value of $x$                                                                                                                                          |
|          |  | <i>Working required</i>                                                                                                                  | 273.375 |      | A1 oe eg $\frac{2187}{8}$ dep on M2 accept 273 – 273.4<br>Both A marks can be awarded for 273.375 if 4.5 is not seen provided M2 has been awarded                                   |
|          |  |                                                                                                                                          |         |      | <b>Total 5 marks</b>                                                                                                                                                                |

| Question |     | Working                                                                                                                                                                                                                                                        | Answer          | Mark | Notes                                                                                                                                                                                                                                                                                                   |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22       | (a) | $9 \div 15 (=0.6)$ <b>or</b> a correct value on the FD scale <b>or</b><br>10 small squares = 1 apple <b>oe or</b><br>25 small squares (1 large square) = $9 \div 3.6 = 2.5$ apple <b>oe</b><br><b>or</b> 29 or 21 or 17                                        |                 | 3    | M1 for use of area to represent frequency <b>or</b> one correct frequency from the 3 additional bars needed, may be seen written on the bar                                                                                                                                                             |
|          |     | $9 + 10 \times 2.9 + 5 \times 4.2 + 5 \times 3.4$ <b>or</b><br>$9 + 29 + 21 + 17$ <b>or</b><br>$9 + 0.1 \times (10 \times 29 + 5 \times 42 + 5 \times 34)$ <b>or</b><br>$(90 + 290 + 210 + 170) \times 0.1$ <b>or</b><br>$(3.6 + 11.6 + 8.4 + 6.8) \times 2.5$ |                 |      | M1 (dep on M1) for a fully correct method, allow one error in products or number of squares but must be the sum of 4 parts                                                                                                                                                                              |
|          |     | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                                                                | 76              |      | A1                                                                                                                                                                                                                                                                                                      |
|          | (b) | $\frac{15}{12 + 25 + 15}$ <b>or</b><br>$\frac{150}{120 + 250 + 150}$ <b>or</b><br>$\frac{6}{4.8 + 10 + 6}$ <b>oe</b>                                                                                                                                           |                 | 2    | M1 method to find correct probability or an answer of $\frac{n}{52}$ where $n < 52$ <b>or</b> $\frac{15}{m}$ where $m > 15$ <b>or</b><br>$\frac{p}{520}$ where $p < 520$ <b>or</b> $\frac{150}{q}$ where $q > 150$ <b>or</b><br>$\frac{r}{20.8}$ where $r < 20.8$ <b>or</b> $\frac{6}{s}$ where $s > 6$ |
|          |     | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                                                                | $\frac{15}{52}$ |      | A1 <b>oe</b> accept 0.28(846...) or 28(.8...) % rounded or truncated                                                                                                                                                                                                                                    |
|          |     |                                                                                                                                                                                                                                                                |                 |      | <b>Total 5 marks</b>                                                                                                                                                                                                                                                                                    |

| Question      | Working                                                                                                                                                                                                                                                                                                                              | Answer | Mark | Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23            | $\frac{12}{x} \times \frac{x-12}{x-1}$ oe or $\frac{x-12}{x} \times \frac{12}{x-1}$ oe                                                                                                                                                                                                                                               |        | 5    | M1 for a correct expression for P(P,Y) or P(Y,P)                                                                                                                                                                                                                                                                                                                                                                                                                                |
|               | $2\left(\frac{12}{x} \times \frac{x-12}{x-1}\right) = \frac{18}{47}$ oe or<br>$\frac{12}{x} \times \frac{x-12}{x-1} + \frac{x-12}{x} \times \frac{12}{x-1} = \frac{18}{47}$ oe                                                                                                                                                       |        |      | M1 for a correct equation for $P(P,Y) + P(Y,P) = \frac{18}{47}$<br>This M mark implies first M mark                                                                                                                                                                                                                                                                                                                                                                             |
|               | $18x^2 - 1146x + 13536 (=0)$ oe or<br>$9x^2 - 573x + 6768 (=0)$ oe or<br>$3x^2 - 191x + 2256 (=0)$ oe                                                                                                                                                                                                                                |        |      | M1 dep on M2 simplified to a 3 term quadratic<br>$(ax^2 + bx + c (=0))$ in any form) with at least 2 coefficients ( $a$ or $b$ or $c$ ) are correct                                                                                                                                                                                                                                                                                                                             |
|               | $(3x - 47)(x - 48) (=0)$<br>or<br>$x = \frac{- -191 \pm \sqrt{(-191)^2 - (4 \times 3 \times 2256)}}{2 \times 3}$<br>or<br>$3\left[\left(x - \frac{191}{6}\right)^2 - \left(\frac{191}{6}\right)^2\right] + 2256 (=0)$<br>$\left(x + \frac{-191}{2 \times 3}\right)^2 - \left(\frac{-191}{2 \times 3}\right)^2 + \frac{2256}{3} (=0)$ |        |      | M1 ft dep on first M1 for solving <i>their</i> 3-term quadratic equation using any method – if factorising, allow brackets which expand to give 2 out of the 3 terms correct. If using the formula or completing the square allow one sign error and some simplification as far as<br>$(x =) \frac{191 \pm \sqrt{36\,481 - 27\,072}}{6}$ or<br>$3\left(x - \frac{191}{6}\right)^2 - \frac{9409}{12} (=0)$<br><br>Award this mark for answers of 48 and $\frac{47}{3}$ dep on M3 |
|               | <i>Working required</i>                                                                                                                                                                                                                                                                                                              | 48     |      | A1 cao, dep on first 3 M marks.<br><br>Do not award if non-integer solution also given.                                                                                                                                                                                                                                                                                                                                                                                         |
| Total 5 marks |                                                                                                                                                                                                                                                                                                                                      |        |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

| WITH REPLACEMENT |                                                                                                                                                                                                                                                                                                                                                                                                          |  |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23               | $\frac{12}{x} \times \frac{x-12}{x}$ oe or $\frac{x-12}{x} \times \frac{12}{x}$ oe                                                                                                                                                                                                                                                                                                                       |  | 5 | M0                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                  | $2\left(\frac{12}{x} \times \frac{x-12}{x}\right) = \frac{18}{47}$ oe or<br>$\frac{12}{x} \times \frac{x-12}{x} + \frac{x-12}{x} \times \frac{12}{x} = \frac{18}{47}$ oe                                                                                                                                                                                                                                 |  |   | M1<br>for a correct equation for $P(P,Y) + P(Y,P) = \frac{18}{47}$<br><b>This M mark DOES NOT imply the first M mark</b>                                                                                                                                                                                                                                                                                                                                             |
|                  | $18x^2 - 1128x + 13536 (=0)$ oe or<br>$9x^2 - 564x + 6768 (=0)$ oe or<br>$3x^2 - 188x + 2256 (=0)$ oe                                                                                                                                                                                                                                                                                                    |  |   | M1<br>dep on previous M1 simplified to a 3 term quadratic<br>$(ax^2 + bx + c (=0))$ in any form) with at least 2 coefficients ( $a$ or $b$ or $c$ ) are correct                                                                                                                                                                                                                                                                                                      |
|                  | $(x =) \frac{- -188 \pm \sqrt{(-188)^2 - (4 \times 3 \times 2256)}}{2 \times 3}$<br>or<br>$3\left[\left(x - \frac{188}{6}\right)^2 - \left(\frac{188}{6}\right)^2\right] + 2256 (=0)$ oe<br>or<br>$(x =) \frac{188 \pm 4\sqrt{517}}{6}$<br>or $\left(x + \frac{-188}{2 \times 3}\right)^2 - \left(\frac{-188}{2 \times 3}\right)^2 + \frac{2256}{3} (=0)$<br>or<br>$(x =) 46(.491756)$ and $16(.174910)$ |  |   | M1<br>fit dep on second M1 for solving <i>their</i> 3-term quadratic equation using any method – if factorising, allow brackets which expand to give 2 out of the 3 terms correct. If using the formula or completing the square allow one sign error and some simplification as far as<br>$(x =) \frac{188 \pm \sqrt{35344 - 27072}}{6}$ or<br>$3\left(x - \frac{188}{6}\right)^2 - \frac{2068}{3} (=0)$<br><br>Award this mark for both values of $x$<br>dep on M2 |
|                  | <i>Working required</i>                                                                                                                                                                                                                                                                                                                                                                                  |  |   | A0                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                  |                                                                                                                                                                                                                                                                                                                                                                                                          |  |   | <b>Total 3 marks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

| Question |     | Working                                                                                                                                                                                                                                                                | Answer          | Mark | Notes                                                                                                                                                                                                                                         |
|----------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24       | (a) | $-3(x+4)^2 \dots\dots$<br><b>or</b><br>$-3[(x+4)^2 \dots\dots]$<br><b>or</b><br>$-3\left(x + \frac{-24}{2 \times -3}\right)^2 + \dots\dots$                                                                                                                            |                 | 3    | M1 for a start to completing the square<br><b>or</b><br>correct substitution into<br>$a\left(x + \frac{b}{2a}\right)^2 + \dots\dots \text{ from the formula } a\left(x + \frac{b}{2a}\right)^2 - \frac{(b)^2}{4a} + c$                        |
|          |     | $-3[(x+4)^2 - 4^2] \dots\dots$ <b>or</b><br>$-3[(x+4)^2 - 4^2 \dots\dots]$ <b>or</b><br>$-3[(x+4)^2 - 16 \dots\dots]$ <b>or</b><br>$-3\left(x + \frac{-24}{2 \times -3}\right)^2 - \frac{(-24)^2}{4 \times -3} \dots\dots$<br><b>or</b><br>$-3(x+4)^2 + 48 \dots\dots$ |                 |      | M1 for correctly completing the square but terms do not need to be simplified and 10 may or may not be present<br><b>or</b><br>correct simplification of the first two parts of<br>$a\left(x + \frac{b}{2a}\right)^2 - \frac{(b)^2}{4a} (+c)$ |
|          |     | <i>Correct answer scores full marks (unless from obvious incorrect working)</i>                                                                                                                                                                                        | $58 - 3(x+4)^2$ |      | A1 oe eg $-3(x+4)^2 + 58$                                                                                                                                                                                                                     |
|          | (b) |                                                                                                                                                                                                                                                                        | $(-3, 58)$      | 1    | B1 ft their expression in part (a)                                                                                                                                                                                                            |
|          | (c) |                                                                                                                                                                                                                                                                        | $x = -3$        | 1    | B1 ft their expression in part (a) <b>or</b> ft their $x$ coordinate in part (b)                                                                                                                                                              |
|          |     |                                                                                                                                                                                                                                                                        |                 |      | <b>Total 5 marks</b>                                                                                                                                                                                                                          |

| Question |  | Working                                                                                                                                                                                                                                                                                                                                                                                                                         | Answer | Mark | Notes                                                                                                                                                         |
|----------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 25       |  | $(FB =) \frac{12}{\sin 30} (= 24) \text{ oe or } (FB =) \frac{12 \sin 90}{\sin 30} (= 24) \text{ or}$<br>$(AB =) \frac{12}{\tan 30} (= 12\sqrt{3} = 20.78...) \text{ and } (FB =)$<br>$\sqrt{12^2 + (12\sqrt{3})^2} (= 24)$                                                                                                                                                                                                     |        | 5    | M1 method to find an expression for the length of $FB$                                                                                                        |
|          |  | $(BT =) \frac{2}{3} \times "24" (= 16)$                                                                                                                                                                                                                                                                                                                                                                                         |        |      | M1 dep on M1 for using the ratio 3 : 2 to find an expression for the length of $BT$                                                                           |
|          |  | $(FT =) \sqrt{"24"^2 + "16"^2} (= 8\sqrt{13} = 28.8...) \text{ oe or}$<br>$(FT =)$<br>$\sqrt{"24"^2 + "16"^2 - 2 \times "24" \times "16" \times \cos 90} (= 8\sqrt{13} = 28.8...) \text{ oe or}$<br>$(AT =) \sqrt{"(12\sqrt{3})"^2 + "16"^2} (= 4\sqrt{43} = 26.2...) \text{ oe or}$<br>$(AT =)$<br>$\sqrt{"(12\sqrt{3})"^2 + "16"^2 - 2 \times "(12\sqrt{3})" \times "16" \times \cos 90} (= 4\sqrt{43} = 26.2...) \text{ oe}$ |        |      | M1 dep on first M1 for a complete method to find an expression for the length of $FT$ or $AT$<br>ft their value of $BT$ from incorrect use of the ratio       |
|          |  | $\sin ATF = \frac{12}{"8\sqrt{13}"}$ oe or $\tan ATF = \frac{12}{"4\sqrt{43}"}$ oe or<br>$\cos ATF = \frac{"4\sqrt{43}"}{"8\sqrt{13}"}$ oe                                                                                                                                                                                                                                                                                      |        |      | M1 dep on M2 method to find $\sin ATF$ or $\cos ATF$ or $\tan ATF$<br>ft their value of $FT$ or $AT$ from their value of $BT$ from incorrect use of the ratio |
|          |  | Working required                                                                                                                                                                                                                                                                                                                                                                                                                | 24.6   |      | A1 dep on M2 for answer in the range 24.5 to 24.7                                                                                                             |
|          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                 |        |      | Total 5 marks                                                                                                                                                 |