Mark Scheme (Final)

Summer 2018

Pearson Edexcel GCE AS Mathematics

Statistics & Mechanics (8MA0/02)
Edexcel and BTEC Qualifications

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Summer 2018

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.
- 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.
- 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/indicative content will not be exhaustive.
- When examiners are in doubt regarding the application of the mark scheme to a candidate’s response, a senior examiner must be consulted before a mark is awarded.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
General Instructions for Marking

1. The total number of marks for the paper is 60.

2. These mark schemes use the following types of marks:

   - M marks: Method marks are awarded for ‘knowing a method and attempting to apply it’, unless otherwise indicated.
   - A marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
   - B marks are unconditional accuracy marks (independent of M marks)
   - Marks should not be subdivided.

3. Abbreviations
   These are some of the traditional marking abbreviations that will appear in the mark schemes.

   - bod – benefit of doubt
   - ft – follow through
     - the symbol \( \sqrt{ } \) will be used for correct ft
   - cao – correct answer only
   - cso - correct solution only. There must be no errors in this part of the question to obtain this mark
   - isw – ignore subsequent working
   - awrt – answers which round to
   - SC: special case
   - o.e. – or equivalent (and appropriate)
   - d or dep – dependent
   - indep – independent
   - dp decimal places
   - sf significant figures
   - * The answer is printed on the paper or ag-answer given

4. All M marks are follow through.
   A marks are ‘correct answer only’ (cao.), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through.
   After a misread however, the subsequent A marks affected are treated as A ft, but answers that don’t logically make sense e.g. if an answer given for a probability is >1 or <0, should never be awarded A marks.
5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected.

6. Where a candidate has made multiple responses and indicates which response they wish to submit, examiners should mark this response. If there are several attempts at a question which have not been crossed out, examiners should mark the final answer which is the answer that is the most complete.

7. Ignore wrong working or incorrect statements following a correct answer.

8. Mark schemes will firstly show the solution judged to be the most common response expected from candidates. Where appropriate, alternatives answers are provided in the notes. If examiners are not sure if an answer is acceptable, they will check the mark scheme to see if an alternative answer is given for the method used. If no such alternative answer is provided but the response is deemed to be valid, examiners must escalate the response for a senior examiner to review.
### Section A: Statistics

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<tr>
<th>Qu</th>
<th>Scheme</th>
<th>Marks</th>
<th>AO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (a)</td>
<td>Positive (correlation)</td>
<td>B1</td>
<td>1.2</td>
</tr>
<tr>
<td>1 (b)</td>
<td>Every extra point gives £4.5(0) more on pay (o.e.)</td>
<td>B1</td>
<td>3.4</td>
</tr>
<tr>
<td>1 (c)</td>
<td>e.g. For points &lt; 11 it would give pay &lt; 0 which is ridiculous</td>
<td>B1</td>
<td>2.4</td>
</tr>
</tbody>
</table>

#### Notes

(a) **B1** for “positive”.

   Allow an interpretation e.g. “as points increase pay increases” is B1

   Read whole answer: contradictory comments such as “positive correlation, as points increase pay decreases” scores B0

(b) **B1** for any correct comment conveying idea of £s per point and including a correct value; must have idea of rate. Can condone missing £ sign. Accept 4.5 e.g. “every 10 points earns an extra (or increase) of £45” is B1

   BUT “every point earns £4.5(0)” is B0 *doesn’t have idea of rate*

(c) **B1** for a suitable comment mentioning “points” or “pay” (o.e. e.g. “amount”) or commenting on “small sample” or “range of points” used to find line

   The following examples would score B1

   Can say that $n$ points (for $n < 10.4$) would give negative pay so not suitable

   Any comment suggesting that some jobs would end up with negative pay

   Don’t know the range of points used to find the regression line

   A small sample of size 8 may not be representative to cover all jobs

   B0 for a focus on “qualifications” or “hours” worked only

   The following examples would score B0

   Some jobs require no (or low) skills or qualifications (*need negative pay*)
2 (a) [Let \( p = P(F \mid C) \)]
Tree diagram or some other method to find an equation for \( p \)
\[
0.1 \times 0.09 + 0.3 \times 0.03 + 0.6 \times p = 0.06
\]
\[
p = 0.07 \quad \text{i.e. } 7\%
\]
(b) e.g. \( P(B \text{ and } F) = 0.3 \times 0.03 = 0.009 \) but
\[
P(B) \times P(F) = 0.3 \times 0.06 = 0.018
\]
These are not equal so not independent

Notes

(a) M1 for selecting a suitable method to find the missing probability
\( \text{e.g. sight of tree diagram with } 0.1, 0.3, 0.6 \text{ and } 0.09, 0.03, p \text{ suitably placed} \)
\( \text{e.g. sight of VD with } 0.009 \text{ for } A \cap F \text{ and } B \cap F \text{ and } 0.6p \text{ suitably placed} \)
or attempt an equation with at least one correct numerical and
one “\( p \)” product (not necessarily correct) on LHS
\( \text{or for sight of } 0.06 - (0.009 + 0.009) \text{ (o.e. } e.g. 6 - 1.8 = 4.2\% \)\)
1st A1 for a correct equation for \( p \) (May be implied by a correct answer)
\( \text{or for the expression } \frac{0.06 - (0.009 + 0.009)}{0.6} \text{ (o.e.)} \)
2nd A1 for 7% (accept 0.07)
\( \text{Correct Ans: Provided there is no incorrect working seen award 3/3} \)
\( \text{e.g. may just see tree diagram with } 0.07 \text{ for } p \text{ (probably from trial and improv’)} \)

(b) B1 for a suitable explanation…may talk about 2nd branches on tree diagram
and point out that 0.03 \( \neq \) 0.06 but need some supporting calculation/words
\( \text{Can condone incorrect use of set notation (it is not on AS spec) provided} \)
the rest of the calculations and words are correct.
<table>
<thead>
<tr>
<th>Qu</th>
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<tbody>
<tr>
<td>(a)</td>
<td>Let $N =$ the number of games Naasir wins, $N \sim B(15, \frac{1}{3})$</td>
</tr>
<tr>
<td>(i)</td>
<td>$P(N = 2) = 0.059946...$ awrt 0.0599</td>
</tr>
<tr>
<td>(ii)</td>
<td>$P(N &gt; 5) = 1 - P(N \leq 5) = 0.38162...$ awrt 0.382</td>
</tr>
<tr>
<td>(b)</td>
<td>$H_0 : p = \frac{1}{3}$ $H_1 : p &gt; \frac{1}{3}$</td>
</tr>
<tr>
<td>(i)</td>
<td>Let $X =$ the number of games Naasir wins, $X \sim B(32, \frac{1}{3})$</td>
</tr>
<tr>
<td>(ii)</td>
<td>$P(X \geq 16) = 1 - P(X &lt; 16) = 0.03765$ ($&lt; 0.05$)</td>
</tr>
</tbody>
</table>

**Notes**

(a) M1 for selecting a binomial model with correct $n$ or $p$  
Award for sight of $B(15, \frac{1}{3})$ (o.e. e.g. in words) or implied by 1 correct answer  
1st A1 for awrt 0.0599 (from a calculator). Allow 0.05995  
2nd A1 for awrt 0.382 (from a calculator)

(b) B1 for correctly stating both hypotheses in terms of $p$ or $\pi$  
Accept $p = 0.3$ or any exact equivalent. $H_1 : p \geq \frac{1}{3}$ is B0  
M1 for selecting a suitable model to use for the test.  
Award for sight of $B(32, \frac{1}{3})$ (o.e. e.g. in words) or implied by 0.03765  
1st A1 for use of the model to calculate an appropriate probability using calc.  
Sight of $P(X \geq 16)$ and answer awrt 0.0377

**ALT** CR May use CR so award 1st A1 for CR of $X \geq 16$ must have seen some probabilities though: 1 of $P(X \leq 15) = 0.9623$ or $P(X \leq 14) = 0.9224$ or 0.9223  
2nd A1 for conclusion in context that there is support for Naasir’s claim  
Must mention “Naasir” or “his” and “claim” or “method” (o.e.)  
or e.g. probability of winning a game is $\geq \frac{1}{3}$ or has increased  
Dependent on M1 and 1st A1 but can ignore hypotheses.

**SC** Use of 0.3 for $\frac{1}{3}$  
If used 0.3 instead of $\frac{1}{3}$ in (a) and score M0A0A0 can condone use of 0.3 in (b)  
1st A1 ft needs $P(X \geq 16) = 0.0138$  
or CR of $X \geq 15$ and sight of 1 of $P(X \geq 15) = 0.0327$ or $P(X \geq 14) = 0.0694$  
2nd A1 as before with 0.3 instead $\frac{1}{3}$ (if appropriate)
<table>
<thead>
<tr>
<th>Qu</th>
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<th>Marks</th>
<th>AO</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>(a) ( \bar{x} = 10.2 ) (2222…) awrt ( 10.2 )</td>
<td>B1</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td>(b) ( \sigma_x = 3.17 ) (20227…) awrt ( 3.17 )</td>
<td>B1ft</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td>Sight of “knots” or “kn” (condone knots/s etc)</td>
<td>B1</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>October …… since it is windier in the autumn or month of the hurricane or latest month in the year</td>
<td>B1</td>
<td>2.2b</td>
</tr>
<tr>
<td></td>
<td>(c) They represent outliers</td>
<td>B1</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>(d)(i) ( Y ) has low median so expect lowish mean (but outlier so &gt; 7) and ( Y ) has big range/IQR or spread so expect larger st.dev Suggests ( B )</td>
<td>M1</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>(ii) M1 for a comment relating to location that mentions both median and mean and a comment relating to spread that mentions both range/IQR and standard deviation and leads to choosing ( B, C ) or ( D ) Choosing ( A ) or ( E ) is ( M0 ) Incorrect/false statements score ( M0 ) e.g. ( Q_3 = (\text{mean } + \sigma) ) or identify ( Q_2 = \text{mean} ) or ( Y ) has small spread</td>
<td>A1</td>
<td>2.2b</td>
</tr>
</tbody>
</table>

### Notes

**NB** \( \bar{x} = \frac{184}{18} \) and \( \sigma_x = \sqrt[3]{\frac{2062}{18}} \)

(a) B1 for \( \bar{x} = 10.2 \) (allow exact fraction) [This is an LDS mark]

(b) 1st B1ft allow 3.2 from a correct expr’ accept \( s = 3.26 \) (3984…) [ft use of n/a] Treating n/a as 0 May see \( n = 31 \) or \( \bar{x} = 5.9354… \) which is B0 in (a) but here in (b) it gives \( \sigma_x = 5.59(34…) \) or \( s = 5.6858… \) (awrt 5.69) and scores 1st B1 2nd B1 accept kn accept in (a) or (b) (allow nautical miles/hour) [This is an LDS mark]

(c) 1st B1 choosing October but accept September. 2nd B1 for stating that (Camborne) is windier in autumn/winter months “because it is winter/autumn/windier/colder in “month” ” Sep \( \leq \) ”Month” \( \leq \) Mar scores B1B1 for “month” = Sep or Oct and B0B1 for other months in range

(d)(i) B1 for outlier or the idea of an extreme value allow “anomaly”

(ii) M1 for suitable inference i.e. \( B \) (accept \( D \) or \( B \) or \( D \)) \textbf{M1 must} be scored

**ALT** Use of outliers: outlier is \( (\text{mean } + 3\sigma) \) \( (B = 19.9), (C = 18.95), (D = 20.2) \) Must see at least one of these values and compare to \( Y \)’s outlier[leads to \( D \) or \( B \) ]
(a) \( P(X = 4) = P(X = 2) \) so \( P(X = 4) = 0.35 \)
\( P(X = 1) = P(X = 3) \) and \( P(X = 1) + P(X = 3) = 1 - 0.7 \)
So 
\[
\begin{array}{c|cccc}
 x & 1 & 2 & 3 & 4 \\
 P(X = x) & 0.15 & 0.35 & 0.15 & [0.35] \\
\end{array}
\]

(b) Let \( A = \) number of spins that land on 4 \( A \sim B(60, \text{"0.35"}) \)
\[ P(A > 30) = 1 - P(A \leq 30) \]
\[ = 1 - 0.99411\ldots = \text{awrt 0.00589} \]

(c) \( Y - X \leq 4 \Rightarrow \frac{12}{X} - X \leq 4 \) or \( 12 - X^2 \leq 4X \) (since \( X > 0 \)) o.e.
\[ 0 \leq X^2 + 4X - 12 \Rightarrow 0 \leq (X + 6)(X - 2) \] so \( X \geq 2 \)
\[ P(Y - X \leq 4) = P(X \geq 2) = 0.35 + 0.15 + 0.35 = 0.85 \]

Notes

(a) M1 for using the given information to obtain \( P(X = 4) \)
Award for statement \( P(X = 4) = P(X = 2) \) or writing \( P(X = 4) = 0.35 \)
A1 for getting fully correct distribution (any form that clearly identifies probs)
e.g. can be list \( P(X = 1) = 0.15, P(X = 3) = \ldots \) etc
[Condone missing \( P(X = 2) \) as this is given in QP]
\[
\begin{array}{c|c}
P(X = x) & 0.15 & 0.35 \\
 x & 1,3 & 2,4 \\
\end{array}
\]

(b) B1 for selecting a suitable model, sight of \( B(60, \text{"0.35"}) \) o.e. in words
f.t. their \( P(X = 4) \) from part (a).
Can be implied by \( P(A > 30) = \text{awrt 0.9941} \) or final answer = \text{awrt 0.00589}
M1 for using their model and interpreting “more than half”
Need to see \( 1 - P(A \leq 30) \). Can be implied by awrt 0.00589
A1 for awrt 0.00589

(c) 1st M1 for translating the prob. problem into a correct mathematical inequality
Just an inequality in 1 variable. May be inside a probability statement.
ALT Table of values:
\[
\begin{array}{c|cccc}
 X & 1 & 2 & 3 & 4 \\
 Y & 12 & 6 & 4 & 3 \\
\end{array}
\]
or values of
\( Y - X = 11, 4, 1, -1 \)

2nd M1 for solving the inequality leading to a range of values, allow 1 or 2 slips
May be a quadratic or cubic but must lead to a set of values of \( X \) or \( Y - X \)
ALT Table or values: They must state clearly which values are required
Both Ms can be implied by a correct answer (or correct ft of their distb’n)
A1 for interpreting the inequality and solving the problem i.e. 0.85 cao
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<th>AOs</th>
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<tr>
<td>6.</td>
<td>Equation in $t$ only</td>
<td>M1</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>$2 = 9t - \frac{1}{2} 10t^2$</td>
<td>A1</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td>$5t^2 - 9t - 2 = 0 = (5t + 1)(t - 2)$</td>
<td>DM1</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td>$T = 2$ (only)</td>
<td>A1</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(4 marks)

Notes:

**M1**: Complete method to give equation in $t$ only. This mark is for a complete method for the TOTAL time i.e. for finding sufficient equations, with usual rules, correct no. of terms in each equation but condone sign errors and $g$ does not need to be substituted

**A1**: A correct equation or correct equations (e.g. if they find the speed, 11 ms$^{-1}$, when the ball strikes the ground and then use that to find the total time or if they split the time (e.g. 0.9s up and 1.1s down or 0.9s + 0.9s + 0.2s))

N.B. $g = 10$ must be substituted in all equations used.

**DM1**: Dependent on first M1, for solving a 3 term quadratic to find $T$ or for solving their equations to find $T$ or for solving their equations and adding their split times to find $T$

**A1**: $T = 2$ only (i.e. A0 if they give two times)

N.B. If solving a correct quadratic, the DM1 can be implied by a correct answer i.e. the method does not need to be shown, but if there is no method shown and the answer is wrong then award DM0 A0.
### Question 7

<table>
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<tr>
<th>Scheme</th>
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<th>AOs</th>
</tr>
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<tbody>
<tr>
<td>(a) (i)</td>
<td>B1</td>
<td>1.1b</td>
</tr>
<tr>
<td>(ii)</td>
<td>B1</td>
<td>1.1b</td>
</tr>
<tr>
<td>(iii)</td>
<td>B1</td>
<td>1.1b</td>
</tr>
<tr>
<td>(b)</td>
<td>M1</td>
<td>3.1b</td>
</tr>
<tr>
<td>(c)</td>
<td>B1</td>
<td>3.5c</td>
</tr>
</tbody>
</table>

#### Notes:

(a) 

(i) **B1:** 24 (m s\(^{-1}\)) Must be stated i.e. not just inserted on the graph
(ii) **B1**: 48 \( \text{ s } \) (Allow – 48 changed to 48) Must be stated i.e. not just inserted on the graph

(iii) **B1**: A trapezium starting at the origin and ending on the \( t \)-axis.

(b) **M1**: Complete method to find area of trapezium using trapezium rule with correct structure or using two triangles and a rectangle and equate to 4800 to give equation in one unknown

\[
N.B. \quad \frac{1}{2} (T + 80 + 48) \times 24 = 4800 \quad \text{is} \quad M0 \quad \text{(equivalent to using three triangles)}
\]

**OR** they may use \( suvat \) on one or more sections (must have \( a = 0 \) for middle section) and equate total distance travelled to 4800 to give equation in one unknown

**A1ft**: For a correct equation in their unknown \( \text{ft} \) on their 24 and 48 (but must be positive times)

**A1**: For 264 \( \text{s} \)

(c) **B1**:

Either: Include time to change from constant accln to constant velocity and/or time to change from constant velocity to constant deceleration oe

**Or**: Have train accelerating and/or decelerating at a variable rate
<table>
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<tr>
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<th>AOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>8(a)</td>
<td>Multiply out and differentiate ( \text{wrt} ) to time (or use of product rule i.e. must have two terms with correct structure)</td>
<td>M1</td>
<td>1.1a</td>
</tr>
<tr>
<td>( v = 2t^3 - 3t^2 + t )</td>
<td></td>
<td>A1</td>
<td>1.1b</td>
</tr>
<tr>
<td>( 2t^3 - 3t^2 + t = 0 ) and solve: ( t(2t - 1)(t - 1) = 0 )</td>
<td>DM1</td>
<td>1.1b</td>
<td></td>
</tr>
<tr>
<td>( t = 0 ) or ( t = \frac{1}{2} ) or ( t = 1 ); any two</td>
<td>A1</td>
<td>1.1b</td>
<td></td>
</tr>
<tr>
<td>All three</td>
<td>A1</td>
<td>1.1b</td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b)</td>
<td>Find ( x ) when ( t = 0, \frac{1}{2}, 1 ) and 2: ( (0, \frac{1}{32}, 0, 2) )</td>
<td>M1</td>
<td>2.1</td>
</tr>
<tr>
<td>Distance = ( \frac{1}{32} + \frac{1}{32} + 2 )</td>
<td>M1</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>( 2\frac{1}{16} ) (m) oe or 2.06 or better</td>
<td>A1</td>
<td>1.1b</td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c)</td>
<td>( x = \frac{1}{2} t^2 (t - 1)^2 )</td>
<td>M1</td>
<td>3.1a</td>
</tr>
<tr>
<td>( \frac{1}{2} ) perfect square so ( x \geq 0 ) i.e. never negative</td>
<td>A1 csO</td>
<td>2.4</td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(10 marks)</td>
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</table>

**Notes:**

(a)

**M1:** Must have 3 terms and at least two powers going down by 1  
**A1:** A correct expression  
**DM1:** Dependent on first M, for equating to zero and attempting to solve a cubic  
**A1:** Any two of the three values (Two correct answers can imply a correct method)  
**A1:** The third value

(b)

**M1:** For attempting to find the values of \( x \) (at least two) at their \( t \) values found in (a) or at \( t = 2 \)  
or equivalent e.g. they may integrate their \( v \) and sub in at least two of their \( t \) values  
**M1:** Using a correct strategy to combine their distances (must have at least 3 distances)
A1: \(2 - \frac{1}{16}\) (m) oe or 2.06 or better

(c)

M1: Identify strategy to solve the problem such as:

(i) writing \(x = \frac{1}{2} \times\) perfect square

(ii) or using \(x\) values identified in (b).

(iii) or using calculus i.e. identifying min points on \(x-t\) graph.

(iv) or using \(x-t\) graph.

A1 cso: Fully correct explanation to show that \(x \geq 0\) i.e. never negative
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<tbody>
<tr>
<td>9(a)</td>
<td>Equation of motion for $P$</td>
<td>M1</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>$2mg \ T = 2m \ \frac{5g}{7}$</td>
<td>A1</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td>$T = \frac{4mg}{7}$</td>
<td>A1</td>
<td>1.1b</td>
</tr>
<tr>
<td>(b)</td>
<td>Since the string is modelled as being inextensible</td>
<td>B1</td>
<td>3.4</td>
</tr>
<tr>
<td>(c)</td>
<td>Equation of motion for $Q$ or for whole system</td>
<td>M1</td>
<td>3.3</td>
</tr>
<tr>
<td></td>
<td>$T - kmg = km \ \frac{5g}{7}$</td>
<td>A1</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td>$\frac{4mg}{7} - kmg = km \ \frac{5g}{7}$ oe and solve for $k$</td>
<td>DM1</td>
<td>1.1b</td>
</tr>
<tr>
<td></td>
<td>$k = \frac{1}{3} \text{ or 0.333 or better}$</td>
<td>A1</td>
<td>1.1b</td>
</tr>
<tr>
<td>(d)</td>
<td>e.g. The model does not take account of the mass of the string (SEE BELOW for alternatives)</td>
<td>B1</td>
<td>3.5b</td>
</tr>
<tr>
<td>(9 marks)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Condone both equations of motion appearing in (a) if used in (c)

(a)

**M1:** Resolving vertically for $P$ with usual rules, correct no. of terms but condone sign errors and $a$ does not need to be substituted (N.B. inconsistent omission of $m$ is M0). Allow $ma$ on RHS for M1

**A1:** A correct equation (allow if they use 7 instead of $\frac{5g}{7}$)

**A1:** A correct answer of form $cmg$, where $c = \frac{4}{7}$ oe or 0.57 or better

(b)

**B1:** String is inextensible. N.B. B0 if any extras (wrong or irrelevant) given

(c)

**M1:** Resolving vertically for $Q$ or for a whole system equation, with usual rules, correct no. of terms but condone sign errors and neither $T$ nor $a$ does need to be substituted
A correct equation (allow if they use \( \frac{5g}{7} \) instead of \( \frac{5g}{7} \))

Sub for \( T \) using their answer from (a), if necessary, and solve to give a numerical value of \( k \) (i.e. \( m' \)'s must cancel)

\[ k = \frac{1}{3} \text{ or } 0.333 \text{ or better.} \]

(e.g. Pulley may not be smooth
   Pulley may not be light
   Particles may not be moving freely e.g. air resistance
   Balls may not be particles
   String may not be light
   String may not be inextensible
   (but allow converses in all cases e.g. 'pulley smooth')

N.B. B0 if any extra incorrect answer is given BUT ignore incorrect consequence of a correct answer.

Also note: B0 : Use of a more accurate value of \( g \)