

# Mark Scheme (Final)

## January 2008

GCE

### GCE Mathematics (6677/01)

## 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.

## General Instructions for GCE Mathematics Marking

1. The total number of marks for the paper is 75.
2. The Edexcel Mathematics 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.

M (method) marks in Mechanics are usually awarded for the application of some mechanical principle to produce an equation:

e.g. resolving in a particular direction, taking moments about a point, applying the conservation of momentum principle, etc.

To earn the M mark the following criteria are (usually) applied:

The equation

(i) should have the correct number of terms

(ii) should be dimensionally correct

In addition, for a resolution, all terms that need to be resolved are resolved.

### 3. Abbreviations

These are some of the traditional marking abbreviations that will appear in the mark schemes and can be used if you are using the annotation facility on ePEN.

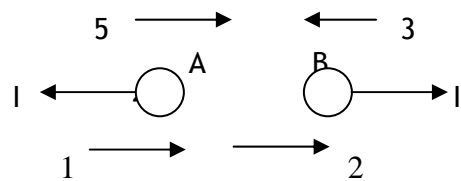
- bod - benefit of doubt
- ft - follow through
- the symbol  $\checkmark$  will be used for correct ft
- cao - correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- isw - ignore subsequent working
- awrt - answers which round to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

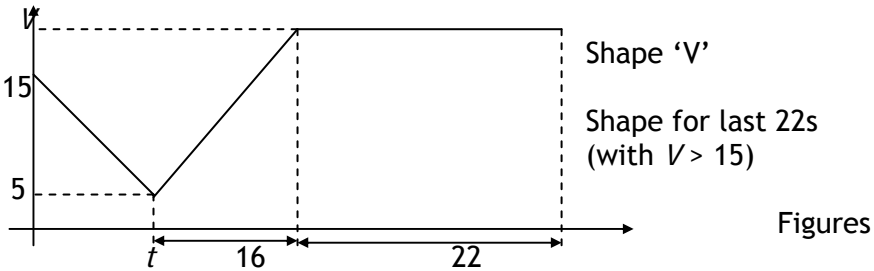
4. All A marks are 'correct answer only' (cao.) unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft, but manifestly absurd answers should never be awarded A marks.
5. For misreading 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. If you are using the annotation facility on ePEN, indicate this action by 'MR' in the body of the script.
6. If a candidate makes more than one attempt at any question:
7. If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
8. If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.
9. Ignore wrong working or incorrect statements following a correct answer.
10. Marks for each question are scored by 'clicking' in the marking grids that appear below each student response on ePEN. The maximum mark allocation for each question/part question(item) is set out in the marking grid and you should allocate a score of '0' or '1' for each mark as shown:

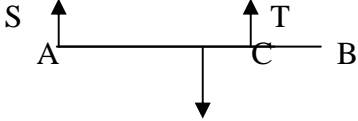
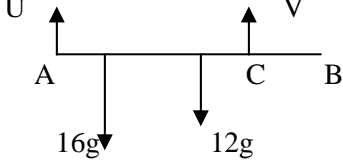
	0	1
aM		•
aA	•	
bM1		•
bA1	•	
bB	•	
bM2		•
bA2		•

11. Be careful when scoring a response that is either all correct or all incorrect. It is very easy to click down the '0' column when it was meant to be '1' and all correct.

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6677 Mechanics 1 Mathematics  
Mark Scheme

Question Number	Scheme	Marks
1(a)	 $I = 4(5 - 1) = \underline{16 \text{ N}}$	M1 A1 (2)
(b)	<p>CLM: <math>4 \times 5 - m \times 3 = 4 \times 1 + m \times 2</math></p> $\Rightarrow m = \underline{3.2}$ <p><b>or</b></p> $16 = m(3 + 2)$ $\Rightarrow m = \underline{3.2}$	M1 A1 DM1 A1 (4) <b>or</b> M1 A1 DM1 A1 (4) <b>6</b>
2.(a)	$27 = 0 + \frac{1}{2} a \cdot 3^2 \Rightarrow a = \underline{6}$	M1 A1 (2)
(b)	$v = 6 \times 3 = \underline{18 \text{ m s}^{-1}}$	M1 A1 f.t. (2)
(c)	<p>From <math>t = 3</math> to <math>t = 5</math>, <math>s = 18 \times 2 - \frac{1}{2} \times 9.8 \times 2^2</math></p> $\text{Total ht.} = s + 27 = \underline{43.4 \text{ m}, 43 \text{ m}}$	M1 A1 f.t. M1 A1 (4) <b>8</b>

Question Number	Scheme	Marks
3.(a)		<p>B1 B1 B1 (3)</p>
(b)	$\frac{1}{2}(15 + 5) \times t = 120$ $\Rightarrow t = 12 \rightarrow T = 12 + 16 + 22 = \underline{50 \text{ s}}$	<p>M1 M1 A1 (3)</p>
(c)	$120 + \frac{1}{2}(V + 5) \cdot 16 + 22V = 1000$ $\text{Solve: } 30V = 840 \Rightarrow V = \underline{28}$	<p>M1 <u>B1</u> A1 DM1 A1 (5) <b>11</b></p>
4.(a)	<p>R (// plane): <math>49 \cos \theta = 6g \sin 30</math></p> $\Rightarrow \cos \theta = 3/5 *$	<p>M1 A1 A1 (3)</p>
(b)	<p>R (perp to plane): <math>R = 6g \cos 30 + 49 \sin \theta</math></p> $R \approx \underline{90.1 \text{ or } 90 \text{ N}}$	<p>M1 A1 DM1 A1 (4)</p>
(c)	<p>R (// to plane): <math>49 \cos 30 - 6g \sin 30 = 6a</math></p> $\Rightarrow a \approx 2.17 \text{ or } 2.2 \text{ m s}^{-2}$	<p>M1 A2,1,0 A1 (4) <b>11</b></p>

Question Number	Scheme	Marks
5.(a)	 $M(A): T \times 4 = 12g \times 2.5$ $T = \underline{7.5g \text{ or } 73.5 \text{ N}}$ $R(\uparrow) S + T = 12g$ $\Rightarrow S = \underline{4.5g \text{ or } 44.1 \text{ N}}$	M1 A1 A1 M1 A1 (5)
(b)	 $M(A) V \times 4 = 16g \times y + 12g \times 2.5$ $V = \underline{4gy + 7.5g \text{ or } 39.2y + 73.5 \text{ N}}$	M1 A1 A1 (3)
(c)	$V \leq 98 \Rightarrow 39.2y + 73.5 \leq 98$ $\Rightarrow y \leq 0.625 = 5/8$ <p>Hence "load must be no more than 5/8 m from A" (o.e.)</p>	M1 DM1 A1 (3) <b>11</b>
6.(a)	$\text{Speed} = \sqrt{5^2 + 8^2} \approx \underline{9.43 \text{ m s}^{-1}}$	M1 A1 (2)
(b)	<p>Forming <math>\arctan 8/5</math> or <math>\arctan 5/8</math> oe</p> $\text{Bearing} = 360 - \arctan 5/8 \text{ or } 270 + \arctan 8/5 = \underline{328}$	M1 DM1 A1 (3)
(c)	<p>At <math>t = 3</math>, p.v. of <math>P = (7 - 15)\mathbf{i} + (-10 + 24)\mathbf{j} = -8\mathbf{i} + 14\mathbf{j}</math></p> <p>Hence <math>-8\mathbf{i} + 14\mathbf{j} + 4(u\mathbf{i} + v\mathbf{j}) = \mathbf{0}</math></p> $\Rightarrow \underline{u = 2, v = -3.5}$	M1 A1 M1 DM1 A1 (5)
(d)	<p>p.v. of <math>P</math> <math>t</math> secs after changing course <math>= (-8\mathbf{i} + 14\mathbf{j}) + t(2\mathbf{i} - 3.5\mathbf{j})</math></p> $= 7\mathbf{i} + \dots$ <p>Hence total time <math>= \underline{10.5 \text{ s}}</math></p>	M1 DM1 A1 (3) <b>13</b>

Question Number	Scheme	Marks
7.(a)	$B: \quad 2mg - T = 2m \times 4g/9$ $\Rightarrow T = \underline{10mg/9}$	M1 A1 A1 (3)
(b)	$A: \quad T - \mu mg = m \times 4g/9$ <p>Sub for <math>T</math> and solve: <math>\mu = 2/3</math> *</p>	M1 <u>B1</u> A1 DM1 A1 (5)
(c)	<p>When <math>B</math> hits: <math>v^2 = 2 \times 4g/9 \times h</math></p> <p>Deceleration of <math>A</math> after <math>B</math> hits: <math>ma = \mu mg \Rightarrow a = 2g/3</math></p> <p>Speed of <math>A</math> at <math>P</math>: <math>V^2 = 8gh/9 - 2 \times 2g/3 \times h/3</math></p> $\Rightarrow V = \frac{2}{3} \sqrt{(gh)}$	M1 A1 M1 A1 f.t. DM1 A1 (6)
(d)	<p>Same tension on <math>A</math> and <math>B</math></p>	B1 (1)  <b>15</b>