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Mathematics 6360

MM2B Mechanics 2B

Report on the Examination

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General

Many of the candidates were well prepared for this paper, achieving marks over seventy out of a possible seventy-five, with a significant number achieving full marks. A small number of candidates, however, achieved a total mark of less than ten. They must have gained little benefit from following the course.

Candidates lost credit by not answering the questions asked; for example, in question 2 part (c), by not giving the angle to the nearest degree, and in question 8 part (a), by not **explaining** why the tension was 49N.

A considerable amount of 'creative' algebra was seen when the answer was given, particularly in questions 5 part (a) and 7 part (b).

It was noticeable that a number of candidates used two or more methods when attempting to answer a question. It is to the candidate's advantage to indicate which method they would prefer the examiner to mark.

Question 1

This was found to be a good introduction to the paper. In part (b), instead of using conservation of energy, a few found the maximum height that the box reached in its motion. However, because they rounded or truncated this height, these candidates did not usually obtain the exact answer of 1720J. Most candidates gave simple modelling assumptions in part (d) although a few gave one response in two different ways.

Question 2

In part (a), many candidates used the word "symmetrical" in their explanations but others seemed to feel that an equal area on each side of PQ was adequate. In part (b), most recognised the need to take moments, and usually did so about the line AB. The common error was to use 5cm for the distance of the centre of mass of area $EFGH$, being the distance from EF, rather than 35cm, the distance from the line AB. In part (c), many candidates did not give the answer to the nearest degree.

Question 3

Most candidates completed this question successfully. A few used $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ in part (b) and obtained $\mathbf{v} = (6 + 3t)\,\mathbf{i} + (30 - 6t^2)\,\mathbf{j}$, rather than the given answer. After they had done the integration of $\mathbf{a}$, a number of candidates 'invented' the $6\mathbf{i} + 30\mathbf{j}$ terms required.

Question 4

Most candidates were successful in this question. The usual error occurred when candidates took moments about one end, normally the end on the land. They did not consider that the reaction vertically upwards on the rod was $65g\ \text{N}$, acting at the point where the rod was potentially pivoting.

Question 5

Many candidates completed part (a) well. A number did not use conservation of energy whilst many considered $\frac{1}{2}m(7v)^2$ to be $\frac{7}{2}mv^2$; regardless of these errors it was common for such

candidates to arrive at the printed result $v = \sqrt{\frac{ag}{12}}$. In part (b), the required components, R, mg and $\frac{mv^2}{r}$, appeared frequently in the equation but often not with the appropriate signs.

Question 6

Parts (a) and (b) caused few problems for the vast majority of candidates. In part (c) it was common to see the frictional force to be $5g \times 0.4 = 19.6\text{N}$, but this was often not multiplied by the distance moved, $0.5\ (\text{m})$, to find the work done.

Question 7

A significant number of candidates created $\frac{\mathrm{d}v}{\mathrm{d}t} = -\lambda v$ without proper justification. The equation $-\lambda mv = ma$ was a necessary step which needed to be seen. Even more knew roughly how to obtain $v = U\mathrm{e}^{-\lambda t}$, but too often algebraic skills were not sufficient and $\ln v = -\lambda t + \ln u$ regularly became $v = \mathrm{e}^{-\lambda t} + U$ before becoming $v = U\mathrm{e}^{-\lambda t}$. This and similar errors were not condoned.

Question 8

In part (a), candidates were asked to **explain** why $T = 49\text{N}$. Many candidates simply showed that $5g = 49$. The fact that particle Q was in equilibrium, or at least was not moving, needed to be stated. Most candidates answered parts (b) and (c) correctly, but there were some instances where three forces appeared in the resolving equations in either or both of these parts.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.