Part 1: Statistical Information

Table 1 shows the distribution of grades for the May 2010 session.

Table 1: Distribution of Grades awarded in May 2010

<table>
<thead>
<tr>
<th>GRADE</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Abs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>18</td>
<td>29</td>
<td>86</td>
<td>98</td>
<td>137</td>
<td>201</td>
<td>21</td>
<td>590</td>
</tr>
<tr>
<td>% of Total</td>
<td>3.05</td>
<td>4.92</td>
<td>14.58</td>
<td>16.61</td>
<td>23.22</td>
<td>34.07</td>
<td>3.56</td>
<td>100</td>
</tr>
</tbody>
</table>

Part 2: Comments regarding candidates’ performance

**Question 1**

(a) A considerable number of candidates found the value of $x$ numerically using a calculator, or thought that $\log 2 - \log 25 = \log 2/\log 25$, which is clearly incorrect. On the other hand, a significant number of candidates expressed 1 as $\log 10$ and found no difficulties in finding $x$ algebraically.

(b) Only a small number of candidates managed to tackle this part correctly. Many did not use the given substitution and decided to take logs of the given equation making serious mistakes such as:

$$\log 0 = 0 \text{ and } \log(a + b - c) = \log a + \log b - \log c.$$  

Some made the substitution and obtained the incorrect equation $y^4 - 10y + 1 = 0$ for $y$. Others found the correct quadratic equation for $y$, but did not find the values of $x$.

Part (c) was very well attempted by most students.

**Question 2**

Part (a) was generally well attempted.

In (a) (i), many candidates obtained the equation $p(x) = (x - 3)^2 - 10$ correctly, but did not conclude that the minimum value is $p(3) = -10$ and went on to find $p'(x) = 0$.

Similarly, the candidates could have found the roots of $p(x) = 0$ directly using the above expression, without having to resort to the formula for the roots of a quadratic equation.

In (a) (ii), few students knew the meaning of the range of a function. A significant number gave the range as $3 - \sqrt{10} < x < 3 + \sqrt{10}$.

Part (b) was very well attempted.
**Question 3**

This question was poorly answered on the whole. Many candidates did not seem to understand this question.

21% did not attempt this question whilst 25% did not score any marks.

(i) Most candidates did not seem to know that the maximum height occurred when $\sin t = 1$ and the minimum when $\sin t = -1$.

The main difficulty in this part was solving the simple equation $16 \cos t = 0$, producing incorrect results such as $t = \cos^{-1} \frac{1}{16}$ or $t = 90^\circ, 270^\circ$.

(ii) This was poorly done. Many candidates just sketched the graph of $y = \sin t$.

(iii) Many candidates found the time for one revolution to be $T = 360^\circ$ instead of $T = 2\pi$ seconds.

(iv) Far too many showed a lack of understanding of integration. Common errors included:

$$\int 16 \sin t \, dt = \frac{1}{16} \cos \frac{t^2}{2} \quad \text{and} \quad \frac{1}{2\pi} \int h(t) \, dt = \int \frac{1}{2\pi} \, dt = \log 2\pi.$$  

Nobody gave the correct interpretation of the integral.

**Question 4**

Parts (i) and (ii) of this problem were well answered in most cases.

In (iii), not all candidates used the formula for the perpendicular distance of a point to a line.

In part (iv), some candidates did not know that the gradient of a tangent to a function can be obtained by finding the derivative of the function at the given point.

**Question 5**

a) Some candidates failed to use binomial expansion correctly to obtain the suggested quadratic approximation of the given function. However, the appropriate value of $x$ was then chosen correctly in most cases.

b) Not all candidates calculated the number of combinations correctly. Some candidates failed to use the earlier results to evaluate the probabilities asked for, later on in the problem.

c) The Venn diagram drawn did not indicate clearly the situation discussed in the problem in most cases. It was clear that most candidates had no clear idea of the difference between probability and percentages of the situations discussed in this problem.
Question 6

a) This problem was well attempted by the candidates. However, there were cases where the required sum was given in terms of $d$, as the common difference was not evaluated.

b) The most common mistake of this problem was \((-\frac{1}{2})^n = (-\frac{1}{2})^n\). Some candidates ignored the meaning of the magnitude of the difference between $S_n$ and $S$ when they tried to obtain the least value of $n$. As a result, $n$ was calculated incorrectly in most cases.

Question 7

About half of the students got the matrix transformations asked in part (i) of this question correctly.

Part (ii) was also duly answered correctly by these students, although some of them calculated the matrix product $AB$ instead of $BA$.

In part (iii), the comment provided by most students was inadequate, failing to mention that the answer is an identity matrix because two successive reflections were done.

Question 8

In part (a), the derivatives of the given functions were worked out correctly by about half the candidates.

As for part (b), not many students got it correctly. However, the fact that the question was well structured enabled most of them to get at least a few marks out of the question.

Question 9

This question was generally poorly answered.

In the differential equation of part (a), many candidates did not separate the variables correctly; some were stumped while they attempted to integrate both sides, whilst others did not find the particular solution correctly.

The candidates fared even worse in part (b) of this question. Most of them had no idea how to find what was required of them. It is interesting to note, however, that a few students managed to find the correct answer to this part of the question without resorting to the sine or cosine rules.

Question 10

Most candidates got very high marks for this question.

The few candidates that got part (a) wrong either did not know how to find the determinant and/or inverse of a $2 \times 2$ matrix, or failed to use matrix multiplication to find the coordinates of $P$, even after having found the inverse matrix correctly.

Again most candidates got part (b) correctly. However, some candidates did not realise that the two matrices are inverses of each other.

Chairperson
Board of Examiners
July 2010