**Coursework reports 2015–16**
**CO0001 Mathematics for business – Coursework (Test) 1**

## General remarks

There were five questions on this coursework and most candidates had time to attempt all five. The coursework followed the same format as in the previous year and covered the same range of material. When preparing for the coursework it is helpful to look at those from previous years and ensure you understand the relevant topics and practise typical questions, so you are familiar with the relevant parts of the syllabus. This year the extra time allowed resulted in more students attempting all questions. It is still not advisable to spend too long on one section of a question, such as drawing a graph, at the expense of answering other sections.

## Comments on specific questions

### Question 1

This question involved using a calculator to evaluate a given formula in various specific cases. In part (a) it required a simple substitution for the value of $d$ and correct use of the calculator.

In (b) $d$ was $\sqrt[3]{100}$ and the key point in substituting this into the formula was not to correct back to two decimal places for $d$, but work to at least three and only correct back once the final answer was found.

In (c) the formula was re-arranged by first squaring both sides to give $t^2$ and then multiplying by $g$ and dividing by 2 to give $d = \frac{t^2 g}{2}$.

In (d) this equation is used by substituting $t = 3$ to find the distance fallen in 3 seconds. Again, it is important to only correct back to two decimal places at the end.

### Question 2

This was a question about equations with straight line graphs and tested the ability of students to draw a straight line graph given the equation $c = 2000 + 10q$ with $c$ on the vertical axis and $q$ on the horizontal axis. Students should be aware that 2000 is the vertical intercept, where $q = 0$ and the line cuts the vertical axis. They then need to find two more points to sketch the graph. Another good point to find is the horizontal intercept where $c = 0$ and $2000 + 10q = 0$ *i.e.* $q = -20$. It is good to find these two intercepts as it gives students an idea of an appropriate scale to use when dividing up the axes into units. A third point can be found by substituting a value of $q$ in the given range into the equation to find the corresponding value of $c$, such as $q = 20$. When sketching a graph students should use a pencil and ruler to draw the axes, and label them appropriately, marking intervals on each axis, then plotting points before joining them, in this case in a straight line. If the three points do not lie on a straight line students should check their calculations as an error has been made.

In (b) this process can be repeated with the new line to find the intercept through the origin, $(0, 0)$. Two other points may be found by substituting for $q$ into the equation, say $q = 100$ and $q = 200$ to give points $(100, 2000)$ and $(200, 4000)$.

In (c) the break-even point is where costs are equal to revenue and may be found algebraically by solving $2000 + 10q = 20q$ to give $q = 200$.

The value of $c$ at this break-even point is found by substituting $q = 200$ into the cost equation giving $c = 2000 + 10 \times 200$ and evaluating to find $c = 4000$.

**Question 3**

This question was about quadratic equations and in part (a) students were required to apply the quadratic formula to the given equation to find the solutions, that is the points where $q = 0$. A clue to the fact that the formula was required is given by the statement in the question to give solutions correct to two decimal places. The formula should be learnt and practised. In this case $a = 1$, $b = -200$ and $c = -1000$. This gives $q = 204.88$ or $q = -4.88$, both correct to two decimal places.

In (b) the profit function is the negative of the function solved in (a). This means the graph of the two functions have symmetry when reflected in the horizontal axis, the $q$ axis. The roots of both will be at the same two points on this axis, which have already been found in part (a). The solutions to the equation in (a) are the roots of the profit function in (b), the points where profit equals zero, or the break-even points.

For (c) the maximum profit is where the gradient of the profit curve equals zero and can be found by differentiating to give $\frac{d\pi}{dq} = -2q + 200$ and setting this to equal zero. Solving $-2q + 200 = 0$ gives $q = 100$. Alternatively, maximum profit is found when $q$ is mid-way between the roots found earlier, since a quadratic is symmetric when reflected in the line vertically through the maximum.

**Question 4**

This question required knowedge of algebraic manipulation of equations to solve them. For (a) simple multiplying out and gathering together of the terms in $x$ gave the solution, which many students were able to do.

In (b) multiplying both sides by $2x$ removed the denominators to give $8 \times 2 = x \times x$ or $16 = x^2$. The negative solution was not given by many students. Here $x = 4$ and $x = -4$ are both solutions to the equation.

For (c) the simplest approach was to square both sides of the equation to give $x^2 = 9x$, then $x^2 - 9x = 0$ leads to $x(x - 9) = 0$ and $x = 0$ or $x = 9$ as final solutions. Many students did not square the 3 on the right hand side of the original equation.

**Question 5**

This question on linear programming gave the set of inequalities for the problem and in part (a) asked students to check whether the point $(20, 25)$ lies in its feasible region. The feasible region is the one which satisfies all the inequalities, so check if the given point is in it by substituting into each. The second inequality, $2x + y \leq 60$, is not true when this point is entered as the left hand side of the inequality is $40 + 25 = 65$. This is not less than or equal to 60, so the given point does not lie in the feasible region. Students needed to produce some working such as this in order to justify their answer rather than just say the point is in the region or no it is not.

In (b) three corners of the feasible region were given.These are the origin, and the two points on the axes, the intercepts. The fourth point can be found where the two lines $x + y = 50$ and $2x + y = 60$ meet. These lines form two of the four boundary sides of the feasible region. The point where they meet can be found solving the equations simultaneously or by sketching the lines and reading off the point of intersection. Solving simultaneously gives $x = 10$ and $y = 40$. So the point $(10, 40)$ is the other corner.

The profit function can then be evaluated at each of the four corner points. The point $(0, 50)$ gives profit of 150 and this is in fact the maximum as the other corners all produce smaller profits. Thus, for (c) the maximum profit is 150. (The units are not specified.)