Candidates' Performance

Module 1 (Calculus and Statistics)

In this year, 2404 candidates sat the examination. The mean score is 61 marks and the standard deviation is 19 marks. Candidates generally performed better in Section A than in Section B.

Section A

Question Number	Performance in General
1 (a)	Very good. Over 85% of the candidates were able to find the values of a and b by setting up two equations involving them.
(b)	Very good. Most candidates were able to find the required probability by using $\mathrm{P}(C \mid D) = \dfrac{\mathrm{P}(C \cap D)}{\mathrm{P}(D)}$.
2 (a)	Very good. Over 90% of the candidates were able to find the required probability by considering the complementary events: 'a person has disease D' and 'a person does not have disease D'.
(b)	Very good. Over 90% of the candidates were able to find the required probability by considering the two different cases when 'a person has disease D' and when 'a person does not have disease D'.
(c)	Very good. Most candidates were able to use the result of (b) to find the required conditional probability. However, some candidates failed to state explicitly that the required conditional probability is less than 0.6 .
3 (a)	Very good. Most candidates were able to use correct combination coefficients in counting.
(b)	Good. Many candidates correctly included the factor $(0.8)^{10}$ in calculating the required probability.
(c)	Good. Many candidates were able to use the results of (a) and (b) to find the required conditional probability.
4 (a) (i)	Very good. Over 95% of the candidates were able to find the required sample proportion.
(ii)	Very good. Over 75% of the candidates were able to use the correct formula to find the approximate 90% confidence interval.
(b)	Good. Many candidates were able to use the result of (a)(i) to estimate the least number of children Mary should survey.
5 (a)	Good. Some candidates were unable to use chain rule $\dfrac{\mathrm{d}g(u)}{\mathrm{d}x} = \dfrac{\mathrm{d}g(u)}{\mathrm{d}u}\dfrac{\mathrm{d}u}{\mathrm{d}x}$ to find the constant β.
(b)	Fair. Many candidates failed to use part (a) to evaluate the definite integral $\int_0^8 \mathrm{f}(x)\mathrm{d}x$, hence they were unable to find the required area.

Question Number	Performance in General
6 (a)	Very good. Over 85% of the candidates were able to expand e^{-6x}, while a small number of candidates failed to show the working steps.
(b)	Very good. About 80% of the candidates were able to find the coefficient of x^4 in the expansion of $e^{-6x}(1-kx^2)^5$ and were able to find the values of k.
7 (a)	Very good. Over 75% of the candidates were able to find $\frac{dy}{dx}$.
(b)	Fair. Although many candidates were able to apply the first derivative test to find the maximum and minimum values of y, only some candidates were able to consider the two end points as well to obtain the greatest value and the least value of y.
8 (a)	Very good. About 80% of the candidates were able to find k by setting up an equation using the slope of the tangent at point A.
(b)	Good. Many candidates were able to consider the indefinite integral in finding $f(x)$, but only some candidates were able to find the exact value of the constant of integration.

Section B

Question Number	Performance in General
9 (a)	Very good. Many candidates were able to find the answer by standardising the normal variable. Only some candidates failed to express the answer in percentage.
(b)	Very good. Only a small number of candidates missed the binomial coefficient.
(c) (i)	Good. Many candidates were able to use the correct combination coefficients in counting.
(ii)	Good. Many candidates were able to find the required conditional probability. Some candidates tried to solve the problem by considering the complementary event, but they wrongly subtracted the probability of 'at least 2 *small* potatoes and exactly 1 *big* potato' from 1 in the numerator, and hence found the incorrect answer.
10 (a)	Very good. Over 85% of the candidates were able to consider the correct Poisson probabilities and found the required sum.
(b)	Very good. About 80% of the candidates were able to find the answer by using the Poisson probability $\frac{7.8^5 e^{-7.8}}{5!}$.
(c)	Good. Many candidates were able to consider the three cases in finding the required probability. However, some candidates wrongly multiplied the term $\left(\frac{1.3^1 e^{-1.3}}{1!}\right)\left(\frac{0.9^1 e^{-0.9}}{1!}\right)$ by 2 and some candidates missed the factors $\left(\frac{0.9^0 e^{-0.9}}{0!}\right)$ and $\left(\frac{1.3^0 e^{-1.3}}{0!}\right)$ in the other terms of the expressions. Hence, they failed to find the correct answer.

Question Number	Performance in General
10 (d)	Good. Some candidates missed the factor $\left(\frac{1.3^0 e^{-1.3}}{0!}\right)$ in the numerator of the conditional probability.
(e)	Fair. Many candidates confused the means of the two Poisson distributions in finding the numerator of the conditional probability.
11 (a)	Fair. Some candidates were able to use the rules of differentiation to find the required derivatives. However, many candidates did not simplify the derivatives obtained.
(b) (i)	Very good. Most candidates were able to use the correct sub-intervals when applying the trapezoidal rule.
(ii)	Very good. Most candidates were able to use $\int_0^1 f(x)\,dx = \frac{\pi-2}{2}$ and the result of (b)(i) to estimate K.
(iii)	Poor. Most candidates failed to prove that $J > 0.177150823$ and were unable to use $K = \frac{\pi-2}{2} - J$ to discuss the nature of estimate of K in (b)(ii). Hence, they failed to draw a correct conclusion.
12 (a)	Fair. Some candidates were able to find T by considering $\frac{d}{dt}\left(\frac{dV}{dt}\right) = 0$, while many candidates did not prove that the rate of change of the volume of rain water in the tank attains its maximum value when $t = T$.
(b)	Fair. Many candidates were able to consider either indefinite integral or definite integral to find the exact value of V. However, only some candidates could use an appropriate substitution to perform the integration.
(c) (i)	Fair. Many candidates failed to express the volume of rain water in the tank in terms of h, and only some candidates were able to use chain rule $\frac{dV}{dt} = \frac{dV}{dh} \times \frac{dh}{dt}$ to find the constant Q.
(ii)	Poor. Most candidates were unable to find the value of h from the value of V at $t = T$ and thus failed to find the required rate of change.

General recommendations

Candidates are advised to:

1. grasp the counting of cases in combinations;
2. grasp the methods of testing for maximum or minimum;
3. grasp the mathematical operations involving natural logarithms;
4. grasp the method of finding $\frac{d}{dt}\sqrt{a+\sqrt{t+b}}$, where a and b are constants;
5. pay attention to the accuracy required for the final answer and keep enough accuracy of intermediate results; and

6. use brackets whenever necessary, missing brackets would result in different meanings. For example,

$$2\int_1^2 (9u^{\frac{1}{2}} - 6u^{\frac{3}{2}} + u^{\frac{5}{2}})\mathrm{d}u \quad \text{and} \quad 2\int_1^2 9u^{\frac{1}{2}} - 6u^{\frac{3}{2}} + u^{\frac{5}{2}}\mathrm{d}u \ ;$$

$$\frac{1}{3\ln 2}\ln(1+2^{3x})+C \quad \text{and} \quad \frac{1}{3\ln 2}\ln 1+2^{3x}+C;$$

$$1-6x+\frac{(-6x)^2}{2!}+\frac{(-6x)^3}{3!}+\frac{(-6x)^4}{4!}+\cdots \quad \text{and} \quad 1-6x+\frac{-6x^2}{2!}+\frac{-6x^3}{3!}+\frac{-6x^4}{4!}+\cdots.$$