Mathematics Extension 2

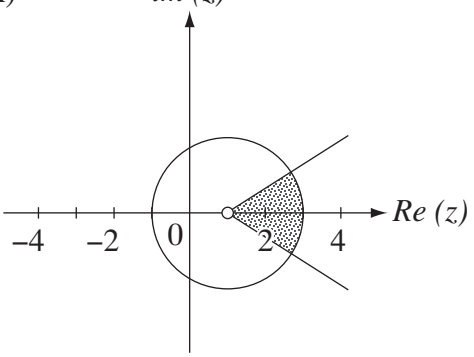
Sample objective-response questions for Section I

1 Find real numbers a and b such that $(1 + 2i)(1 - 3i) = a + ib$.

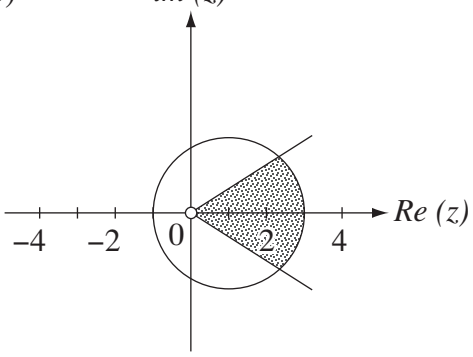
$a =$ ☐☐☐☐* $\quad b =$ ☐☐☐☐*

2 Which of these diagrams represents the region in the complex plane where the inequalities $|z-1| \le 2$ and $-\frac{\pi}{4} \le \arg(z-1) \le \frac{\pi}{4}$ hold simultaneously?

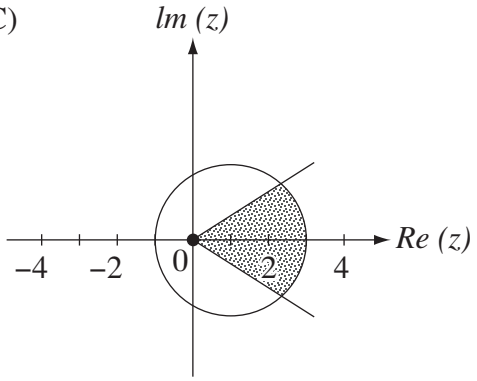
(A)



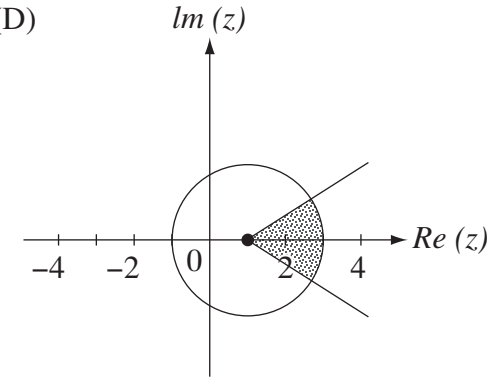
(B)



(C)

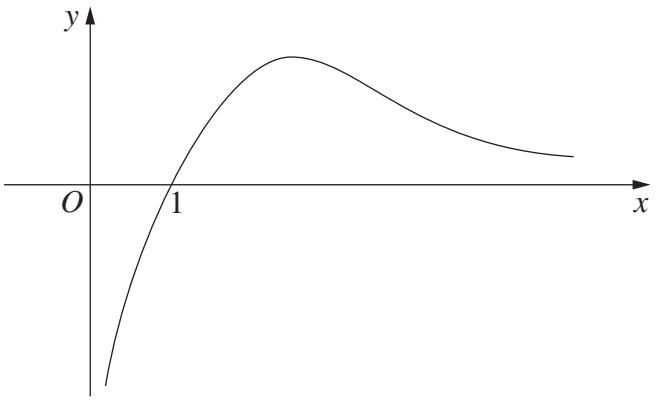


(D)



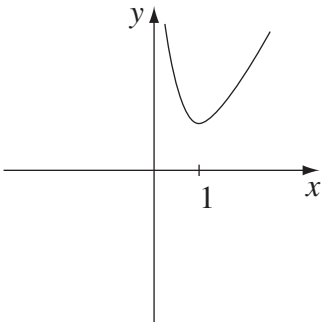
*(*It is proposed that in HSC examinations, candidates would write their answer in a set of answer boxes, such as in the example set above.*)

3 The following diagram shows the graph of $y = g(x)$.

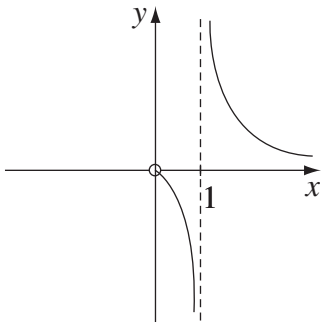


Which of the following best represents the graph of $y = \dfrac{1}{g(x)}$?

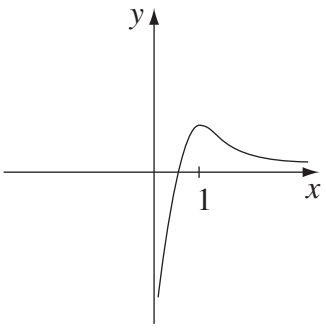
(A)



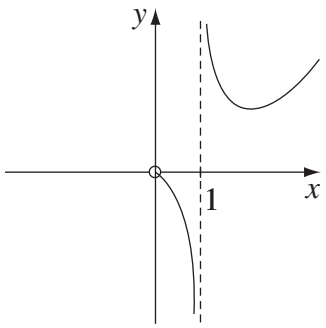
(B)



(C)



(D)



4 A model for the population, P, of elephants in Serengeti National Park is

$$P = \frac{21\,000}{7 + 3e^{-\frac{t}{3}}}$$

where t is the time in years from today.

P satisfies the differential equation

$$\frac{dP}{dt} = \frac{1}{3}\left(1 - \frac{P}{3000}\right)P$$

What is the annual percentage rate of growth today?

								% *

5 Let $P(x) = x^3 + qx^2 + qx + 1$, where q is real. One zero of $P(x)$ is -1.

Given that α is a zero of $P(x)$, which one of the following statements is correct?

(A) $-\frac{1}{\alpha}$ is a zero of $P(x)$

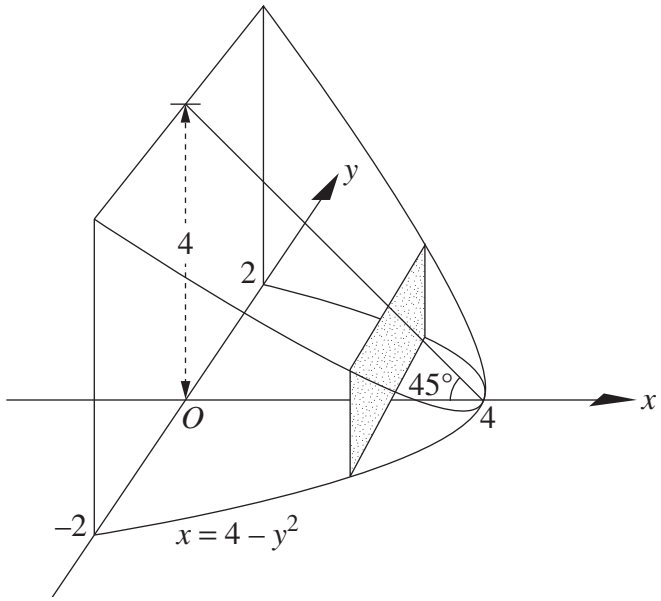
(B) $-\frac{q}{\alpha}$ is a zero of $P(x)$

(C) $\frac{1}{\alpha}$ is a zero of $P(x)$

(D) $\frac{q}{\alpha}$ is a zero of $P(x)$

*(*It is proposed that in HSC examinations, candidates would write their answer in a set of answer boxes, such as in the example set above.*)

6 The base of a solid is the region enclosed by the parabola $x = 4 - y^2$ and the y-axis. The top of the solid is formed by a plane inclined at 45° to the xy-plane. Each vertical cross-section of the solid parallel to the y-axis is a rectangle. A typical cross-section is shown shaded in the diagram.



Which of the following expressions gives a correct representation of the volume of the solid, V?

(A) $V = \int_0^4 \left(4 - x\right)\sqrt{4 - x}\, dx$

(B) $V = 2\int_0^4 \left(4 - x\right)\sqrt{4 - x}\, dx$

(C) $V = \int_0^4 x\sqrt{4 - x}\, dx$

(D) $V = 2\int_0^4 x\sqrt{4 - x}\, dx$