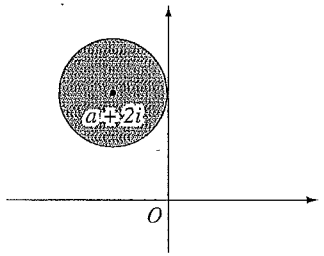
Sample Questions – Mathematics Extension 2

1 Consider the Argand diagram below.



Which inequality could define the shaded area?

(A) $|z-(a+2i)| \geq 1$

(B) $|z-(a+2i)| \leq 1$

(C) $|z+a-2i| \leq 1$

(D) $|z+a-2i| \geq 1$

2 Which of the following is an expression for $\int xe^{2x}\,dx$?

(A) $e^{2x}\left(\frac{x}{2}-\frac{1}{4}\right)+C$

(B) $e^{2x}\left(\frac{x}{2}-1\right)+C$

(C) $e^{2x}\left(x-\frac{1}{4}\right)+C$

(D) $e^{2x}\left(2x-1\right)+C$

3 The polynomial $P(z)$ has real coefficients. The roots of $P(z)=0$ include $z=1-i$ and $z=2$.

What is the lowest possible degree of $P(z)$?

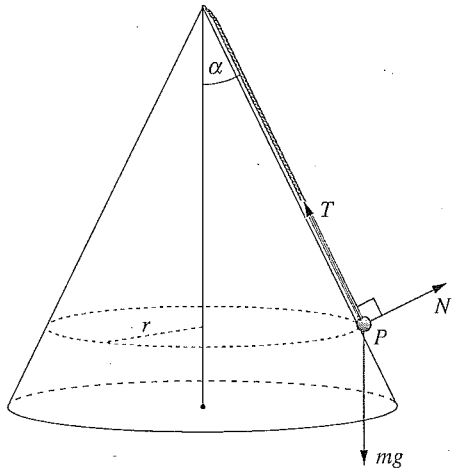
(A) One

(B) Two

(C) Three

(D) Four

4 A light string is attached to the vertex of a smooth vertical cone. A particle P of mass m is attached to the string as shown in the diagram. The particle remains in contact with the cone and rotates with constant angular velocity ω on a circle of radius r. The string and the surface of the cone make an angle of α with the vertical, as shown.



The forces acting on the particle are the tension, T, in the string, the normal reaction, N, to the cone and the gravitational force mg.

Which of the following gives the correct resolution of forces on P in the horizontal and vertical directions?

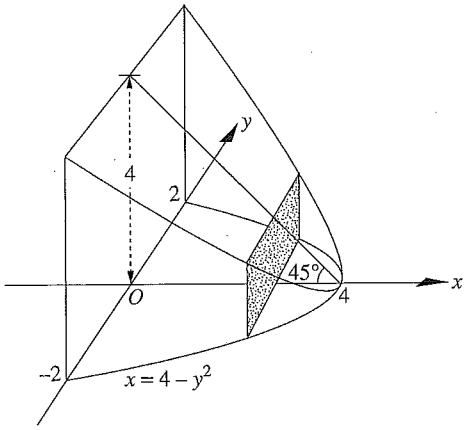
(A) $T\sin\alpha - N\cos\alpha = mr\omega^2$
$T\cos\alpha + N\sin\alpha = mg$

(B) $T\sin\alpha - N\cos\alpha = mr\omega^2$
$T\sin\alpha + N\cos\alpha = mg$

(C) $T\sin\alpha + mr\omega^2 = N\cos\alpha$
$T\cos\alpha + N\sin\alpha = mg$

(D) $T\sin\alpha - N\sin\alpha = mr\omega^2$
$T\cos\alpha + N\sin\alpha = mg$

5 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) $V = \int_0^4 x\sqrt{4-x}\ dx$

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

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

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