As a guideline this paper should be completed in 1 hour.

No Calculator to be used in this examination.

Section A [36 marks]

1. *[Maximum mark 6]*

If $\sin A = \frac{2}{3}$ and A is obtuse, find the exact values of:

a) $\cos A$,

b) $\sin 2A$,

c) $\tan 2A$.

2. *[Maximum mark 6]*

$z_1 = (\cos\frac{2\pi}{3} + i\sin\frac{2\pi}{3})$ and $z_2 = 3(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3})$, where $i = \sqrt{-1}$.

Write $z_1 \div z_2$ in the form $a(\cos x + i\sin x)$, where a and x are exact real numbers.

3. *[Maximum mark 5]*

Find the equation of the curve that passes through (1,-3) and has the differential equation,

$$\frac{dy}{dx} = \frac{y}{x\ln x}.$$

4. *[Maximum mark 5]*

If $f(x) = \ln(4 - 3x)$, find $f''(x)$.

5. *[Maximum mark 4]*

The curve $y = 3x^4 - 4x^3$ has two turning points. Find each point and determine the nature of the turning point.

6. *[Maximum mark 6]*

A biased die is such that the probabilities of landing on each of the numbers from 1 to 6 is given below.

Score	1	2	3	4	5	6
Probability	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{6}$	x	x	x

a) Find the value of x.

b) Hence, find the mean expected score, $E(x)$.

c) Find the variance of the expected score, $V(x)$.

7. *[Maximum mark 4]*

$z^3 = 8\left(\cos\frac{\pi}{3} + i\sin\frac{\pi}{3}\right)$, where $i = \sqrt{-1}$.

Find the solutions for z in the form $z = a\left(\cos\theta + i\sin\theta\right)$.

Section B [24 marks]

8. *[Maximum mark 24]*

i) The line $\frac{x-2}{3} = \frac{2-y}{1} = \frac{z+1}{2}$ is reflected in $x + y + z = 1$. Find the equation of the line. *[5 marks]*

ii) A plane, π, contains the points $A(2,1,4)$ and $B(3,-2,-5)$.

a) Find the unit vector in the direction AB. *[2 marks]*

b) Show that the equation of the plane that contains the points A and B is π: *[4 marks]*

c) Hence, show that the point C with vertices () exists on the plane π. *[1 mark]*

d) Find the area of the triangle ABC. *[4 marks]*

e) The point P is in space defined as (1,3,5). Find the shortest distance from P to the plane π. *[5 marks]*

f) Find the angle between the plane π and the x plane. *[3 marks]*