

1. Find the values of real constants a and b for which $a + bi = (1+i)^3$.

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(3marks)

2. Find the sum of the series

$$\frac{1}{4} - \frac{1}{16} + \frac{1}{64} - \frac{1}{256} + \dots$$

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(3marks)

3. Find, in the form $y = f(x)$, the solution of the differential equation

$$(x+1) \frac{dy}{dx} = y \text{ given that } y = 4 \text{ when } x = 1.$$

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(5marks)

4. Express $\frac{5x+7}{x^2+x-20}$ in partial fractions.

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(4marks)

5. The two circles

$$x^2 + y^2 - 2y - 8 = 0 \text{ and } x^2 + y^2 - 24x + ky - 4 = 0$$

cut orthogonally. Find the value of the constant k.

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(4marks)

6. The radius of a balloon increases from 4cm to 4.01cm. Find, in terms of π , the corresponding increase in the volume of the balloon.

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(4marks)

where k is a real constant. Determine the value of k for which $f(x)$ is continuous at $x = 2$.

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(4marks)

11. Find the value of the constant c for which the equation $4x^2 + 2cx + (c+15) = 0$ has equal roots.

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(3marks)

12. The following table shows empirical values of $y = f(x)$.

x	5	10	15	20	25
y	137.5	350.0	637.5	1000.0	1437.5

Use the trapezium rule to estimate the value of $\int_5^{25} y dx$.

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(3marks)

13. Evaluate $\int_0^1 \frac{x^3}{1+x^4} dx$.

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(3marks)

14. Given that $x = \tan \theta$ and $y = \sec \theta$, show that $\frac{dy}{dx} = \sin \theta$.

(5marks)

The point $(5, 2, -3)$ lies on a plane which is at right angles to the straight line with vector equation $\mathbf{r} = \mathbf{i} + \mathbf{j} - 4\mathbf{k} + \lambda(2\mathbf{i} - 7\mathbf{j} + 11\mathbf{k})$. Find the Cartesian equation of the plane.

(4marks)

Find the value of x which satisfies the equation $\log_2(x^2+3) = 2 + \log_2(2x-3)$, $x \neq \frac{3}{2}$.

(4marks)

17. The area, enclosed by the curve $y = 2\sec 2x$ and the ordinates $x = 0$, $x = \frac{\pi}{8}$, is rotated completely about the axis of x . Find, in terms of π , the volume of the solid generated.

(4marks)

18. Find the general solution of the equation $\cos 2x + 3\sin x = 2$.

(5marks)

19. Find the number of ways in which the letters of the word COCCOBIACCO can be arranged in a row if each arrangement should begin with B and end with I.

(4marks)

10. Find the term independent of x in the expansion of $\left(2x + \frac{1}{x}\right)^6$.

(4marks)

11. Find the sine of the angle between the line $\mathbf{r} = \mathbf{i} - 2\mathbf{j} + 3\mathbf{k} + \mu(2\mathbf{i} + 2\mathbf{j} - \mathbf{k})$ and the plane $\mathbf{r} \cdot (2\mathbf{i} + 3\mathbf{j} + 6\mathbf{k}) = 18$.

(3marks)

Evaluate $\int_{-1}^1 e^{|x|} dx$, leaving your answer in terms of e .

(4marks)

STOP! GO BACK AND CHECK YOUR WORK.