

FREE SAMPLE: THE FIRST 3 QUESTIONS

PAPER 1

70 marks · Questions 1 – 14 · 1 h 45 min

Answer ALL questions. Omission of essential working will result in loss of marks. A calculator may be used. Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified. Where the answer is not exact, show it first to a higher degree of accuracy if you are asked to show that it is correct to a given accuracy.

Question 1 (3 marks)

(a) Find $\int (-6/x^3) \, dx$.

Answer _____

Question 2 (4 marks)

A circle has equation $x^2 + y^2 - 6x + 2y - 90 = 0$.

(a) Find the coordinates of the centre and the radius of the circle.

Answer _____

Question 3 (4 marks)

(a) Prove the identity $\tan \theta + \cot \theta \equiv 2/\sin 2\theta$.

Answer _____

THE WORKED ANSWERS TO THOSE 3 QUESTIONS

Question 1 (3 marks) [Differentiation and integration]

(a) Find $\int (-6/x^3) dx$.

(a) Answer: $3/x^2 + c$

- Integrate each term: $\int ax^n dx = a x^{n+1}/(n+1) + c$.
- $\int (-6/x^3) dx = 3/x^2 + c$.

LOS: Calculus · Differentiation and integration

KEY TAKEAWAY

Integrate term by term, then use a point on the curve to find the constant; for a definite integral subtract the value at the lower limit.

Question 2 (4 marks) [Coordinate geometry]

A circle has equation $x^2 + y^2 - 6x + 2y - 90 = 0$.

(a) Find the coordinates of the centre and the radius of the circle.

(a) Answer: centre (3, -1), radius 10

- Centre = $(-g, -f)$ where $2g = -6$ and $2f = 2$: centre (3, -1).
- Radius = $\sqrt{(g^2 + f^2 - c)} = \sqrt{(9 + 1 - (-90))} = \sqrt{100} = 10$.

LOS: Geometry and Trigonometry · Coordinate geometry

KEY TAKEAWAY

For $x^2 + y^2 + 2gx + 2fy + c = 0$ the centre is $(-g, -f)$ and the radius $\sqrt{(g^2 + f^2 - c)}$; a tangent is perpendicular to the radius at the point of contact.

Question 3 (4 marks) [Trigonometric functions, identities and equations]

(a) Prove the identity $\tan \theta + \cot \theta \equiv 2/\sin 2\theta$.

(a) Answer: Proved: LHS = RHS

- Write $\tan \theta + \cot \theta = \sin \theta / \cos \theta + \cos \theta / \sin \theta = \frac{\sin^2 \theta + \cos^2 \theta}{\sin \theta \cos \theta}$.
- $= \frac{1}{\sin \theta \cos \theta} = \frac{2}{2 \sin \theta \cos \theta} = 2/\sin 2\theta = \text{RHS}$.

LOS: Geometry and Trigonometry · Trigonometric functions, identities and equations

KEY TAKEAWAY

To prove an identity work on one side only, using $\sin^2 A + \cos^2 A = 1$ and the double-angle formulae, until it matches the other side.

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