IYGB GCE

Mathematics FP3

Advanced Level

Practice Paper N

Difficulty Rating: 3.2067/1.4320

Time: 1 hour 30 minutes

Candidates may use any calculator allowed by the regulations of this examination.

Information for Candidates

This practice paper follows closely the Pearson Edexcel Syllabus, suitable for first assessment Summer 2018.

The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 9 questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1

$$I = \int_1^{2.5} \sqrt{x^3 + 1}\ dx .$$

Use Simpson's rule with 6 equally spaced strips, to estimate the value of I .

All steps in the calculation must be shown and the final answer must be correct to 3 significant figures. **(5)**

Question 2

A curve has equation $y = f(x)$ which satisfies the differential equation

$$\frac{dy}{dx} = x^2 - y^2 ,$$

subject to the condition $x = 0$, $y = 2$.

Determine the first 4 terms in the infinite series expansion of $y = f(x)$ in ascending powers of x . **(7)**

Question 3

Find the set of values of x , that satisfy the following inequality.

$$\frac{5x - 1}{|2x - 3|} \geq 1 . \quad \textbf{(6)}$$

Question 4

A parabola H has Cartesian equation

$$y^2 = 12x,\ x \geq 0.$$

The point $P\left(3t^2, 6t\right)$, where t is a parameter, lies on H.

a) Show that the equation of a tangent to the parabola at P is given by

$$yt = x + 3t^2. \qquad \textbf{(4)}$$

The tangent to the parabola at P meets the y axis at the point Q and the point S is the focus of the parabola.

b) Show further that …

i. … PQ is perpendicular to SQ. **(4)**

ii. … the area of the triangle PQS is $\frac{9}{2}|t|\left(1+t^2\right)$. **(3)**

Question 5

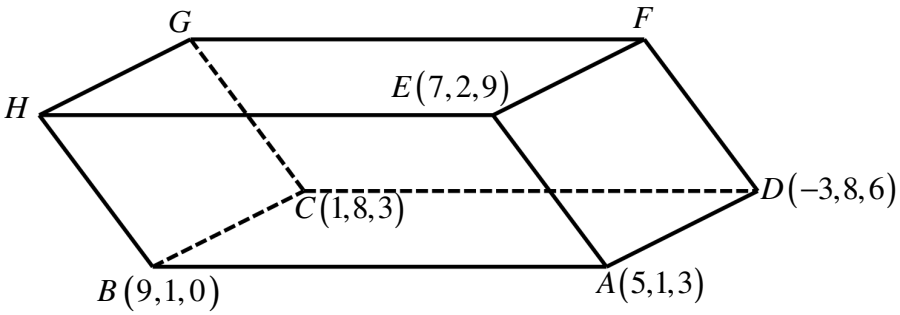
By using the substitution $y = xv$, where $v = f\left(x\right)$, or otherwise, solve the differential equation

$$\frac{dy}{dx} = \frac{3x+2y}{3y-2x},$$

subject to the condition $y = 3$ at $x = 1$.

Give the final answer in the form $F\left(x, y\right) = 12$ **(11)**

Question 6



The figure above shows a parallelepiped.

Relative to a fixed origin O, the vertices of the parallelepiped at A, B, C, D and E have respective position vectors

$$\mathbf{a} = 5\mathbf{i} + \mathbf{j} + 3\mathbf{k},$$
$$\mathbf{b} = 9\mathbf{i} + \mathbf{j},$$
$$\mathbf{c} = \mathbf{i} + 8\mathbf{j} + 3\mathbf{k},$$
$$\mathbf{d} = -3\mathbf{i} + 8\mathbf{j} + 6\mathbf{k}$$
$$\mathbf{e} = 7\mathbf{i} + 2\mathbf{j} + 9\mathbf{k}.$$

a) Calculate the area of the face $ABCD$. **(4)**

b) Show that the volume of parallelepiped is 222 cubic units. **(3)**

c) Hence, find the distance between the faces $ABCD$ and $EFGH$ **(2)**

Question 7

Use standard expansions of functions to find the value of the following limit.

$$\lim_{x \to 0} \left[\frac{\cos^2 3x - 1}{x^2} \right]. \quad \textbf{(6)}$$

Question 8

A point P lies on the ellipse with Cartesian equation

$$\frac{x^2}{64}+\frac{y^2}{16}=1.$$

The point Q is the foot of the perpendicular from the point P to the straight line with equation $x=10$.

a) Sketch, in the same set of axes, the ellipse, the straight line with equation $x=12$ and the straight line segment PQ. **(3)**

The point M is the midpoint of PQ.

b) Determine a Cartesian equation for the locus of M as the position of P varies, further describing this locus geometrically. **(6)**

Question 9

Use the substitution $t=\tan\left(\frac{1}{2}x\right)$ to find an exact simplified value for

$$\int_0^{\frac{\pi}{2}} \frac{1}{2-\cos x}\,dx.$$

Any trigonometric identities to convert $\cos x$ in terms of t must be derived. **(11)**