IYGB GCE

Mathematics FP3

Advanced Level

Practice Paper P

Difficulty Rating: 3.6267/1.6854

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 8 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

a) **Use Simpson's rule** with 4 equally spaced strips to find an estimate for

$$\int_0^{\frac{\pi}{3}} \cos^2 x \ dx .$$ **(4)**

b) **Use the answer of part (a)** to find an estimate for

$$\int_0^{\frac{\pi}{3}} \sin^2 x \ dx .$$ **(2)**

Question 2

Determine the range of values of x that satisfy the following inequality.

$$\frac{x+3}{x} \geq \frac{x}{2-x} .$$ **(6)**

Question 3

$$y = \frac{1}{\sqrt{x}}, \ x > 0$$

a) Find the first four terms in the Taylor expansion of y about $x=1$. **(5)**

b) Use the first **three** terms of the expansion found in part **(a)**, with $x = \frac{8}{9}$ to show that $\sqrt{2} \approx \frac{229}{162}$. **(2)**

Question 4

By considering series expansion, determine the value of the following limit.

$$\lim_{x \to 0} \left[\frac{2x - x\sqrt{x+4}}{\ln(1-3x^2)} \right].$$ **(8)**

No credit will be given for alternative evaluation methods, such as L'Hospital's rule.

Question 5

The straight line L has vector equation

$$\mathbf{r} = \begin{pmatrix} 3 \\ 7 \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} -2 \\ 2 \\ -3 \end{pmatrix},$$

where λ is a scalar parameter.

The plane Π passes through the points $A(11,13,5)$ and $B(15,12,5)$.

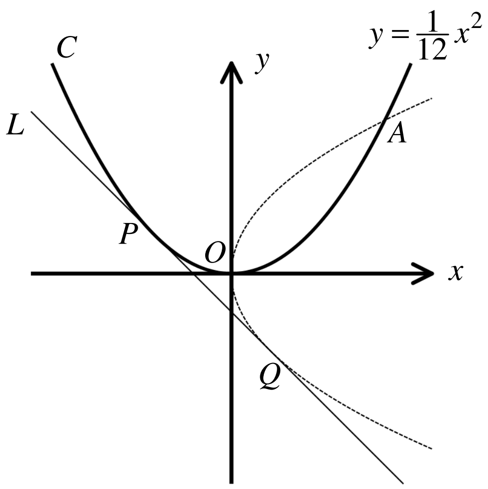
It is further given that Π is parallel to L.

a) Find a Cartesian equation for Π and hence calculate the distance between L and Π. **(7)**

The straight line M is the reflection of L about Π.

b) Determine a vector equation for M. **(6)**

Question 6



The figure above shows the parabola C with equation $y = \frac{1}{12}x^2$.

The dotted line in the figure is the reflection of C in the line $y = x$.

a) Find the exact distance between the focus of C and the focus of its reflection. **(3)**

The parabola intersects its reflection at the origin and at the point A.

b) Determine the coordinates of A. **(3)**

The straight line L is a common tangent to both C and the reflection of C.

L touches C at the point P and the reflection of C at the point Q.

c) Determine the coordinates of P and Q. **(6)**

Question 7

By using the substitution $y = \frac{1}{z}$, or otherwise, solve the differential equation

$$x^2 \frac{dy}{dx} + xy = y^2$$

subject to the condition $y = 2$ at $x = \frac{1}{2}$. **(11)**

Question 8

The curve with equation $y = f(x)$, satisfies

$$\frac{d^2 y}{dx^2} = x + y + 2, \qquad y(0) = 0, \qquad \frac{dy}{dx}(0) = 1.$$

a) Use Taylor expansions to justify the validity of the following approximations.

$$\left(\frac{d^2 y}{dx^2}\right)_n \approx \frac{y_{n+1} - 2y_n + y_{n-1}}{h^2} \qquad \text{and} \qquad \left(\frac{dy}{dx}\right)_n \approx \frac{y_{n+1} - y_{n-1}}{2h}.$$ **(4)**

b) Hence show that $y(0.1) \approx 0.11$ **(4)**

c) Determine, correct to 4 decimal places, the value of $y(0.2)$ and $y(0.3)$. **(4)**
