IYGB GCE

Mathematics MP1

Advanced Level

Practice Paper Y

Difficulty Rating: 4.3333/1.6766

Time: 2 hours 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 10 questions in this question paper.
The total mark for this paper is 100.

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 trigonometric curve is defined by the equation

$$f(x) = 3 - 4\sin(2x + k)°, \ 0 \le x \le 360$$

where k is a constant such that $-90 < k < 90$.

The curve passes through the point with coordinates $(15,5)$ and further satisfies

$$A \le f(x) \le B,$$

for some constants A and B.

a) State the value of A and the value of B. **(2)**

b) Show that $k = -60$. **(4)**

c) Solve the equation $f(x) = -1$. **(5)**

Question 2

a) Given that c is a non zero constant, determine the first four terms, in ascending powers of x, in the binomial expansion of $(1+cx)^6$. **(2)**

It is further given that

$$\left(a + \frac{b}{x}\right)(1+cx)^6 \equiv -\frac{4}{x} + 74 - 576x + \ldots,$$

where a and b are non zero constants.

b) Show that one of the two possible values of c is -3, and find the other. **(9)**

Question 3

$$f(x) = \frac{1}{x}, \ x \in \mathbb{R}, \ x \neq 0.$$

$$g(x) = \frac{1}{x+2} + 2, \ x \in \mathbb{R}, \ x \neq -2.$$

a) Describe mathematically the two transformations that map the graph of $f(x)$ onto the graph of $g(x)$. **(2)**

b) Sketch the graph of $g(x)$.

The sketch must include the …

- … coordinates of all the points where the curve meet the coordinate axes.
- … equations of any asymptotes of the curve. **(4)**

c) Find the coordinates of the points of intersection of $g(x)$ and the line with equation

$$3y + x = 8.$$ **(5)**

Question 4

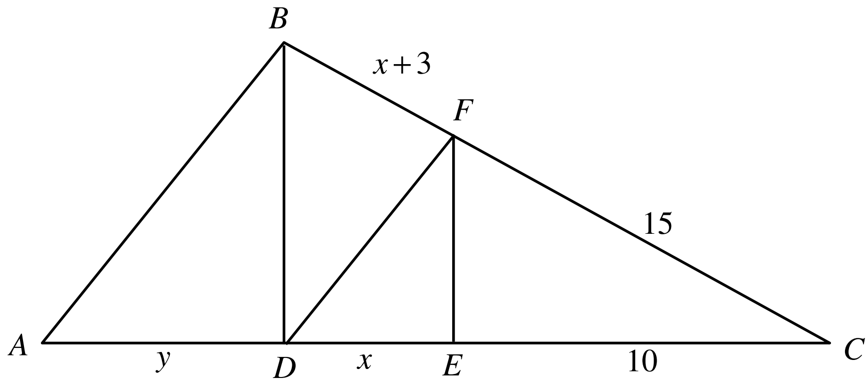
A circle C has equation

$$x^2 + y^2 + 2x - 4y + 1 = 0$$

The straight line L with equation $y = mx$ is a tangent to C.

Find the possible values of m and hence determine the possible coordinates at which L meets C. **(10)**

Question 5



The figure above shows the triangle ABC.

The point D lies on AC so that the straight line BD meets AC at right angles.

The point E lies on AC and the point F lies on BC, so that the straight line DF is parallel to AB and the straight line EF is parallel to BD.

It is further given that the lengths, in cm, of CE, CF, DE, BF and AD are 10, 15, x, $x+3$ and y, respectively.

a) Determine the value of x. **(2)**

b) Show clearly that $y = 9.6$. **(3)**

c) Find, correct to three significant figures, the area of the triangle ABC. **(5)**

Question 6

If $x = \sqrt[3]{2000}$, show clearly that

$$x^2 + \frac{4000}{x} = 300 \times \sqrt[3]{4}.$$ **(5)**

Question 7

Consider the following inequalities

$$5x+13>4(x+2)$$

$$(x-2)^2-k(x-2)(x+3)<0,$$

where k is a non zero constant.

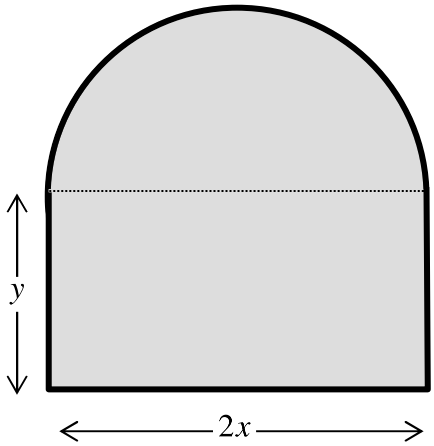
The common solution interval of both these inequalities is

$$-5<x<-\frac{17}{4} \ \cup \ x>m,$$

where m is a non zero constant.

Determine in any order the value of k and the value of m. **(10)**

Question 8



The figure above shows the design of a window which is the shape of a semicircle attached to rectangle. The diameter of the semicircle is $2x$ m and is attached to one side of the rectangle also measuring $2x$ m. The other side of the rectangle is y m.

The **perimeter** of the window is 6 m.

a) Show that the total area of the window, A m^2, is given by

$$A = 6x - \tfrac{1}{2}(4+\pi)x^2 .$$ **(4)**

b) Given that the measurements of the window are such so that A is maximum, show by a method involving differentiation that this maximum value of A is

$$\frac{18}{4+\pi} .$$ **(7)**

Question 9

On the 1st January 2000 a rare stamp was purchased at an auction for £16000 and by the 1st January 2010 its value was four times as large as its purchase price.

The future value of this stamp, £V, t years after the 1st January 2000 is modelled by the equation

$$V = A\mathrm{e}^{pt}, \ t \geq 0,$$

where A and p are positive constants.

On the 1st January 1990 a different stamp was purchased for £2.

The future value of this stamp, £U, t years after the 1st January 1990 is modelled by the equation

$$U = B\mathrm{e}^{2pt}, \ t \geq 0,$$

where B is a positive constant.

Determine the year, during which the two stamps will achieve the same value, according to their modelling equations. **(11)**

Question 10

Determine, in exact simplified surd form, the solution pair (a,b) of the following simultaneous equations.

$$\sqrt{2}(a-1)+\sqrt{6}\,b = 2\left(1+\sqrt{3}\right) \quad \text{and} \quad \sqrt{6}\,a-\sqrt{3}\,b = 2\sqrt{3}.$$

Detailed workings must be shown in this question. **(10)**

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