Paper Reference(s)

# 6672/01

# Edexcel GCE

## Pure Mathematics P2

## Advanced/Advanced Subsidiary

## Monday 23 January 2006 – Afternoon

## Time: 1 hour 30 minutes

| Materials required for examination | Items included with question papers |
| --- | --- |
| Mathematical Formulae (Lilac) | Nil |

**Candidates may only use one of the basic scientific calculators approved by the Qualifications and Curriculum Authority.**

### Instructions to Candidates

In the boxes on the answer book, write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Pure Mathematics P2), the paper reference (6672), your surname, initials and signature.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

### Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 9 questions on this 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 gain no credit.

**N21135A** 

1. ($a$) Write down the binomial expansion, in ascending powers of $x$, of $(1 + 6x)^4$, giving each coefficient as an integer.

**(3)**

($b$) Use your binomial expansion to find the exact value of $601^4$.

**(2)**

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2. **Figure 1**

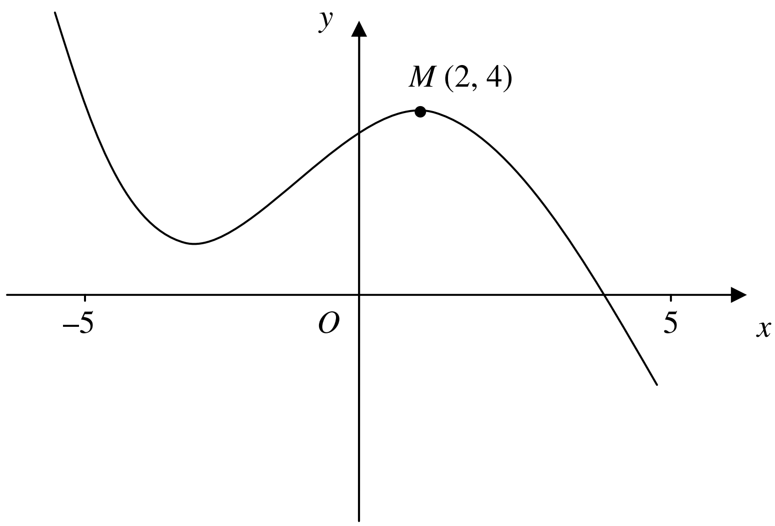


Figure 1 shows the graph of $y = \mathrm{f}(x)$, $-5 \leq x \leq 5$.

The point $M$ (2, 4) is the maximum turning point of the graph.

Sketch, on separate diagrams, the graphs of

($a$) $y = \mathrm{f}(x) + 3$,

**(2)**

($b$) $y = |\mathrm{f}(x)|$,

**(2)**

($c$) $y = \mathrm{f}(|x|)$.

**(3)**

Show on each graph the coordinates of any maximum turning points.

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**3.** Express

$$\frac{2x^2+3x}{(2x+3)(x-2)} - \frac{6}{x^2-x-2}$$

as a single fraction in its simplest form.

**(7)**

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**4.** The point $P$ lies on the curve with equation $y = \ln\left(\frac{1}{3}x\right)$. The $x$-coordinate of $P$ is 3.

Find an equation of the normal to the curve at the point $P$ in the form $y = ax + b$, where $a$ and $b$ are constants.

**(5)**

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**5.** $$\mathrm{f}(x) = 2x^3 - x - 4.$$

($a$) Show that the equation $\mathrm{f}(x) = 0$ can be written as

$$x = \sqrt{\left(\frac{2}{x} + \frac{1}{2}\right)}.$$

**(3)**

The equation $2x^3 - x - 4 = 0$ has a root between 1.35 and 1.4.

($b$) Use the iteration formula

$$x_{n+1} = \sqrt{\left(\frac{2}{x_n} + \frac{1}{2}\right)},$$

with $x_0 = 1.35$, to find, to 2 decimal places, the value of $x_1$, $x_2$ and $x_3$.

**(3)**

The only real root of $\mathrm{f}(x) = 0$ is $\alpha$.

($c$) By choosing a suitable interval, prove that $\alpha = 1.392$, to 3 decimal places.

**(3)**

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**6.**

**Figure 2**

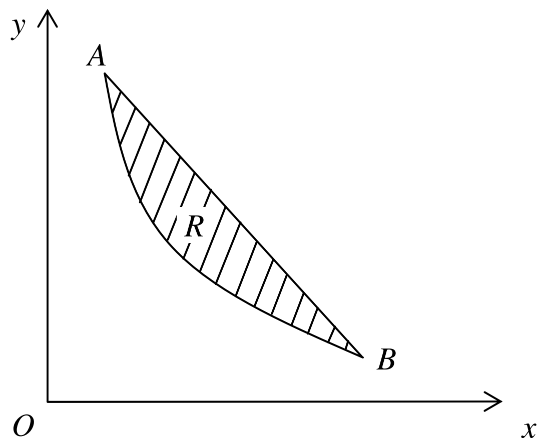


Figure 2 shows the shaded region $R$ which is bounded by the line $y = -2x + 4$ and the curve $y = \dfrac{3}{2x}$.

The points $A$ and $B$ are the points of intersection of the line and the curve.

Find

($a$) the $x$-coordinates of the points $A$ and $B$,

**(4)**

($b$) the exact area of $R$.

**(6)**

**7.** **Figure 1**

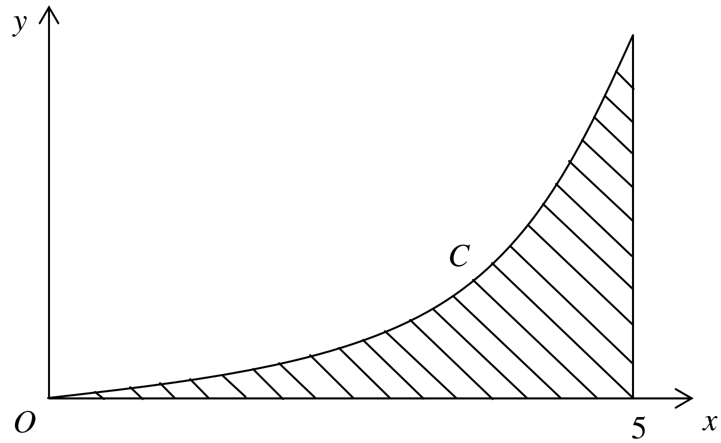


Figure 3 shows part of the curve $C$ with equation $y = e^{0.06x^2} - 1$. The shaded region bounded by $C$, the $x$-axis and the line with equation $x = 5$ represents the cross-section of a skateboarding ramp. The units on each axis are in metres.

(*a*) Copy and complete the table, showing the height $y$ of the ramp. Give the values of $y$ to 3 decimal places.

| $x$ | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $y$ | 0 | 0.062 | | 0.716 | | |

**(3)**

(*b*) Use the trapezium rule, with all the values from your table, to estimate the area of cross-section of the ramp.

**(4)**

The ramp is made of concrete and is 6 m wide.

(*c*) Calculate an estimate for the volume of concrete required to make the ramp.

**(1)**

A builder makes the amount of concrete for the volume calculated in part (*c*).

(*d*) State, with a reason, whether or not there is enough concrete to make the ramp.

**(2)**

**8.** The functions f and g are defined by

$$\mathrm{f}: x \mapsto 2x + \ln 2, \qquad x \in \mathbb{R},$$

$$\mathrm{g}: x \mapsto \mathrm{e}^{2x}, \qquad x \in \mathbb{R}.$$

(*a*) Prove that the composite function gf is

$$\mathrm{gf}: x \mapsto 4\mathrm{e}^{4x}, \qquad x \in \mathbb{R}.$$

**(4)**

(*b*) Sketch the curve with equation $y = \mathrm{gf}(x)$, and show the coordinates of the point where the curve cuts the $y$-axis.

**(1)**

(*c*) Write down the range of gf.

**(1)**

(*d*) Find the value of $x$ for which $\frac{\mathrm{d}}{\mathrm{d}x}[\mathrm{gf}(x)] = 3$, giving your answer to 3 significant figures.

**(4)**

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**9.** (*a*) Show that

(i) $\dfrac{\cos 2x}{\cos x + \sin x} \equiv \cos x - \sin x, \quad x \neq (n - \tfrac{1}{4})\pi,\ n \in \mathbb{Z},$

**(2)**

(ii) $\tfrac{1}{2}(\cos 2x - \sin 2x) \equiv \cos^2 x - \cos x \sin x - \tfrac{1}{2}$ .

**(3)**

(*b*) Hence, or otherwise, show that the equation

$$\cos\theta\left(\frac{\cos 2\theta}{\cos\theta + \sin\theta}\right) = \frac{1}{2}$$

can be written as

$$\sin 2\theta = \cos 2\theta.$$

**(3)**

(*c*) Solve, for $0 \leq \theta < 2\pi$,

$$\sin 2\theta = \cos 2\theta,$$

giving your answers in terms of $\pi$.

**(4)**

**TOTAL FOR PAPER: 75 MARKS**

**END**