MATHEMATICS

Higher Grade Extended Unit Test - UNIT 1

Time allowed - 50 minutes

Read Carefully

1. Full credit will be given only where the solution contains appropriate working.
2. **Calculators may be used.**
3. Answers obtained by readings from scale drawings will not receive any credit.
4. **This Unit Test contains questions graded at all levels.**

Section A

In this section the correct answer to each question is given by one of the alternatives A, B, C or D.
Indicate the correct answer by writing A, B, C or D opposite the number of the question.
Rough working may be done on the paper provided. 2 marks will be given for each correct answer.

1. The equation of a line is $3y + 4x = 12$. The gradient of a line perpendicular to it is

A. $-\frac{4}{3}$

B. $-\frac{3}{4}$

C. $\frac{3}{4}$

D. $\frac{1}{4}$

2. Two functions, f and g, are defined on suitable domains as $f(x) = \frac{2}{x}$ and $g(x) = x^2 + 3$. The value of $g(f(\frac{1}{2}))$ is

A. 19

B. 4

C. $0 \cdot 5$

D. 7

3. The gradient of the tangent to the curve $y = 2x^3 + 3x$ at the point (2, 3) is

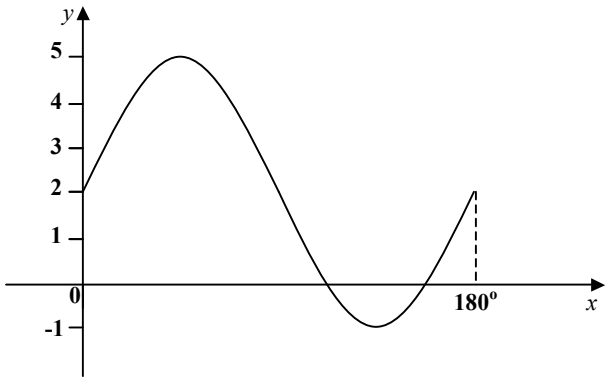
A. 22

B. 27

C. 57

D. 63

4. The diagram shows part of the graph $y = a\sin bx^o + c$.



Which line of the table shows the correct values of *a*, *b* and *c*?

	a	***b***	***c***
A.	2	3	2
B.	5	2	2
C.	3	1	2
D.	3	2	2

5. For the recurrence relation $U_{n+1} = 1 \cdot 5U_n - b$ with $U_1 = 26$ and $U_2 = 35$, the value of U_0 is

A. 20

B. 17

C. 4

D. 35

End of Section A

Section B
ALL QUESTIONS SHOULD BE ATTEMPTED

In this section credit will be given for all correct working.

6. Two functions are defined on suitable domains and are given as

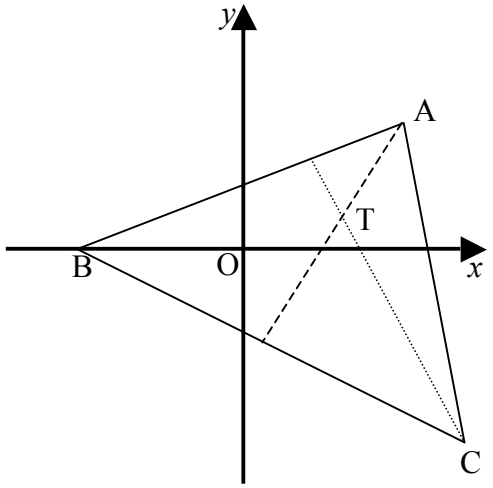
$$f(x) = 3x - \frac{1}{x} \quad \text{and} \quad g(x) = x^2 + 6.$$

Show clearly that $g(f(x)) = 9x^2 + \frac{1}{x^2}$. **3**

7. Triangle ABC has vertices A(9, 8), B$(-8, 0)$ and C$(10, -8)$

(a) Show clearly that the equation of the median through A is

$$2y - 3x + 11 = 0$$ **4**



(b) The line through C with gradient -2 meets the median through A at the point T.

Establish the coordinates of T. **4**

8. Given that $g(x) = x^{-2}(x^3 - \frac{1}{x^2})$, find $g'(x)$. **4**

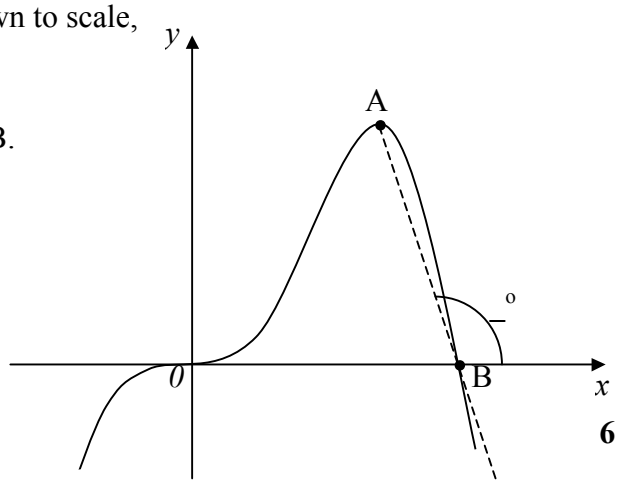
9. A recurrence relation is defined as $U_{n+1} = 0 \cdot 6U_n + 12$, with $U_0 = 200$.

(a) Find the limit (L) of the sequence generated by this recurrence relation. **1**

(b) Find the smallest value of n such that $U_n - L \leq 40$ **3**

10. The curve shown in the diagram, which is not drawn to scale, has equation $y = 8x^3 - 2x^4$.

It has a turning point at A and cuts the x – axis at B.



(a) Find the coordinates of the points A and B. **6**

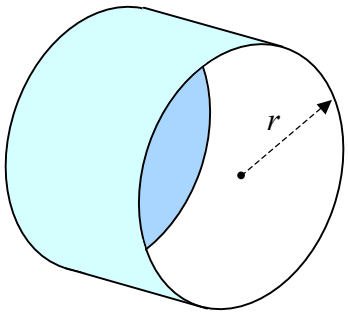
(b) The line joining A and B makes an angle of $\_^{o}$ with the positive direction of the x – axis.

Calculate the value of _ correct to the nearest degree. **3**

11. The point with coordinates (16, 3) lies on the graph with equation $y = \log_a x + 1$..

Find the value of a. **2**

12. A small open cylindrical glass container has a radius of $r$cm as shown in the diagram.



The **total surface area** (A), expressed in terms of r, is found to be

$$A(r) = \frac{120}{r} + \pi r^2.$$

Find the radius of the cylinder so that the surface area (A) is at a minimum.
Give your answer correct to 2-decimal places. **5**

END OF QUESTION PAPER