TEST B

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. If A is the point (-5, -2) and B is the point (-2, 4) then the gradient of AB is

A $-\frac{7}{2}$

B $\frac{1}{2}$

C 0

D 2

2. The derivative of $\dfrac{1}{2x^3}$ is

A $\dfrac{1}{6x^2}$

B $-\dfrac{3}{2x^4}$

C $-6x^2$

D $-\dfrac{3}{2x^2}$

3. The limit of the sequence defined by the recurrence relation $U_{n+1} = 0 \cdot 25U_n + 12$ is

A -16

B 9·6

C 16

D 48

4. The rate of change of the function $f(x) = 3x^2$ when $x = 3$ is

A 3

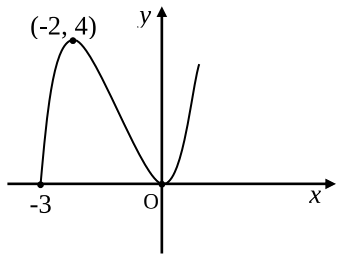
B 18

C 27

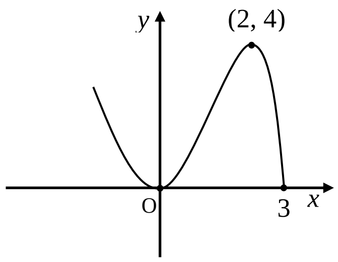
D 54

5. Which graph is most likely to be that of the function $f(x) = x^2(x+3)$?

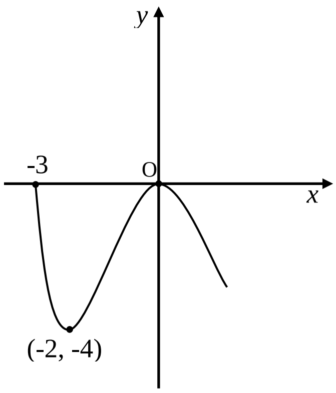
A



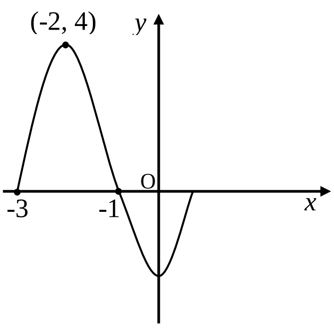
B



C



D

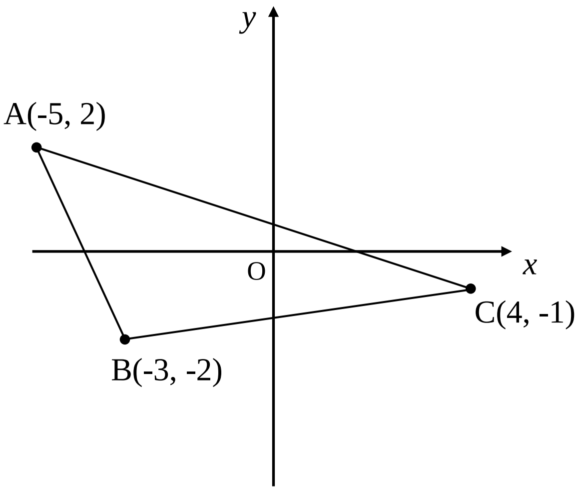


Section B

ALL QUESTIONS SHOULD BE ATTEMPTED

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

6. In the diagram A, B and C are the points (-5, 2), (-3, -2) and (4, -1) respectively.



(a) Find the equation of the line through C parallel to the line AB. **3**

(b) Find the equation of the line perpendicular to BC which passes through the point A. **3**

(c) Find the coordinates of T, the point of intersection of these two lines. **4**

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

$$f(x) = 3 - x \text{ and } g(x) = x - 3.$$

(a) Find an expression, in its simplest form, for $g(f(x))$ **2**

(b) Show that $g(f(x)) - f(g(x)) = -6$ **2**

8. A recurrence relation is defined as $U_{n+1} = aU_n + b$, where a and b are constants.

(a) Given that $U_2 = 14$, $U_3 = 9 \cdot 2$ and $U_4 = 5 \cdot 36$, find the values of the constants a and b. **3**

(b) Hence explain why this recurrence relation has a limit. **1**

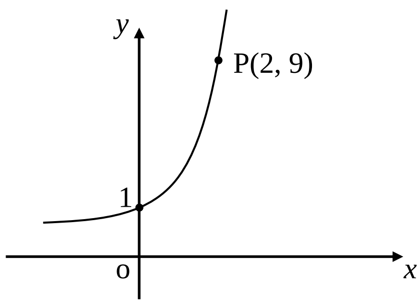
(c) Establish the value of U_1. **2**

9. Find the equation of the tangent to the curve $y = x^3 - 3x$ at the point where $x = 2$. **5**

10. Express the function $f(x) = 3x^2 - 6x + 11$ in the form $p(x-q)^2 + r$. **3**

11. **(a)** The point (125, k) lies on the graph of $y = \log_5 x$. Find the value of k. **1**

(b) The diagram show part of the graph of $y = a^x$. State the value of a.



1

12. Find the gradient of the tangent to the curve with equation $y = 2\cos 3x - \sin^2 x$ at the point with x-coordinate $\frac{\pi}{2}$. **4**

END OF QUESTION PAPER

SET C **Marking Scheme - UNIT 1**

	Give 1 mark for each •	Illustration(s) for awarding each mark
1 **2** **3** **4** **5**	**D** **B** **C** **B** **A**	**Award 2 marks for each correct answer** **10 marks**
6(a)	**ans:** $y + 2x = 7$ **(3 marks)**	
	•[1] knows to find gradient of AB	•[1] $m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$
	•[2] finds gradient	•[2] $m_{AB} = \frac{-2-2}{-3+5} = -2$
	•[3] substitutes values in equation	•[3] $y + 1 = -2(x - 4)$
(b)	**ans:** $y + 7x = -33$ **(3 marks)**	
	•[1] finds gradient of BC	•[1] $m_{BC} = \frac{-1+2}{4+3} = \frac{1}{7}$
	•[2] takes perpendicular gradient •[3] substitutes values in equation	•[2] $m_{PERP} = -7$ •[3] $y - 2 = -7(x + 5)$
(c)	**ans: (-8, 23)** **(4 marks)**	
	•[1] knows to use simultaneous equations •[2] finds value for x •[3] finds value for y •[4] states coordinates	•[1] evidence •[2] $x = -8$ •[3] $y = 23$ •[4] (-8, 23)
7(a)	**ans:** $-x$ **(2 marks)**	
	•[1] substitutes •[2] simplifies	•[1] $g(3 - x)$ •[2] $3 - x - 3 = -x$
(b)	**ans: proof** **(2 marks)**	
	•[1] finds expression for $f(g(x))$ •[2] simplifies to answer	•[1] $3 - (x - 3) = 3 - x - 3 = 6 - x$ •[2] $-x - (6 - x) = -6$

	Give 1 mark for each •	Illustration(s) for awarding each mark
8(a)	**ans:** $\boldsymbol{a = 0{\cdot}8}$ **;** $\boldsymbol{b = -2}$ **(3marks)**	
	•[1] forms a system of equations •[2] finds value for a •[3] finds value for b	•[1] $9{\cdot}2 = 14a + b$; $5{\cdot}36 = 9{\cdot}2a + b$ •[2] $a = 0{\cdot}8$ •[3] $b = -2$
(b)	**ans:** $\boldsymbol{-1 < 0{\cdot}8 < 1}$ **(1 mark)**	
	•[1] states condition for limit	•[1] $-1 < 0{\cdot}8 < 1$
(c)	**ans: 20** **(2 marks)**	
	•[1] substitutes for U_2 •[2] solves for U_1	•[1] $U_2 = 0{\cdot}8\, U_1 -2$; $14 = 0{\cdot}8\, U_1 -2$ •[2] $0{\cdot}8U_1 = 16$; $U_1 = 20$
9	**ans:** $\boldsymbol{y = 9x - 16}$ **(5 marks)**	
	•[1] knows to differentiate •[2] finds derivative •[3] substitutes $x = 2$ in derivative •[4] finds point on the line •[5] substitutes in equation	•[1] $\frac{dy}{dx} =$ •[2] $3x^2 - 3$ •[3] $3(2)^2 - 3 = 9$ •[4] $y = (2)^3 -3(2) = 8 - 6 = 2$; $(2, 2)$ •[5] $y - 2 = 9(x - 2)$
10	**ans:** $\boldsymbol{3(x - 1)^2 + 8}$ **(3marks)**	
	•[1] takes common factor •[2] completes square in bracket •[3] simplifies	•[1] $3(x^2 - 2x) + 11$ •[2] $3[(x - 1)^2 - 1] + 11$ •[3] $3(x - 1)^2 - 3 + 11 = 3(x - 1)^2 + 8$
11(a)	**ans:** $\boldsymbol{k = 3}$ **(1 mark)**	
	•[1] substitutes and solves for k	•[1] $k = \log_5 125$; $k = 3$
(b)	**ans:** $\boldsymbol{a = 3}$ **(1 mark)**	
	•[1] substitutes and solves for a	•[1] $9 = a^2$; $a = 3$
12	**ans:** $\boldsymbol{m = 6}$ **(4 marks)**	
	•[1] knows to take derivative •[2] finds derivative •[3] substitutes •[4] evaluates to answer	•[1] $\frac{dy}{dx} = \ldots\ldots$ •[2] $= -6\sin 3x - 2\sin x \cos x$ •[3] $6\sin(\frac{3\pi}{2}) - 2\sin\frac{\pi}{2}\cos\frac{\pi}{2}$ •[4] $6 - 0 = 6$

Total: 44 marks