

SECTION A

ALL questions should be attempted.

1. A sequence is defined by  $u_{n+1} = 3u_n + 4$  with  $u_1 = 2$ .  
What is the value of  $u_3$ ?
- A 34  
B 21  
C 18  
D 13
2. A circle has equation  $x^2 + y^2 + 8x + 6y - 75 = 0$ .  
What is the radius of this circle?
- A 5  
B 10  
C  $\sqrt{75}$   
D  $\sqrt{175}$
3. Triangle PQR has vertices at P(-3, -2), Q(-1, 4) and R(3, 6).  
PS is a median. What is the gradient of PS?
- A -2  
B  $-\frac{7}{4}$   
C 1  
D  $\frac{7}{4}$
4. A curve has equation  $y = 5x^3 - 12x$ .  
What is the gradient of the tangent at the point (1, -7)?
- A -7  
B -5  
C 3  
D 5

5. Here are two statements about the points S(2, 3) and T(5, -1):

(1) The length of ST = 5 units;

(2) The gradient of ST =  $\frac{4}{3}$ .

Which of the following is true?

- A Neither statement is correct.
- B Only statement (1) is correct.
- C Only statement (2) is correct.
- D Both statements are correct.

6. A sequence is generated by the recurrence relation  $u_{n+1} = 0.7u_n + 10$ .

What is the limit of this sequence as  $n \rightarrow \infty$ ?

A  $\frac{100}{3}$

B  $\frac{100}{7}$

C  $\frac{17}{100}$

D  $\frac{3}{10}$

7. If the exact value of  $\cos x$  is  $\frac{1}{\sqrt{5}}$ , find the exact value of  $\cos 2x$ .

A  $-\frac{3}{5}$

B  $-\frac{2}{\sqrt{5}}$

C  $\frac{2}{\sqrt{5}}$

D  $\frac{3}{5}$

[Turn over

8. What is the derivative of  $\frac{1}{4x^3}$ ,  $x \neq 0$ ?

A  $\frac{1}{12x^2}$

B  $-\frac{1}{12x^2}$

C  $\frac{4}{x^4}$

D  $-\frac{3}{4x^4}$

9. The line with equation  $y = 2x$  intersects the circle with equation  $x^2 + y^2 = 5$  at the points J and K.

What are the  $x$ -coordinates of J and K?

A  $x_J = 1, x_K = -1$

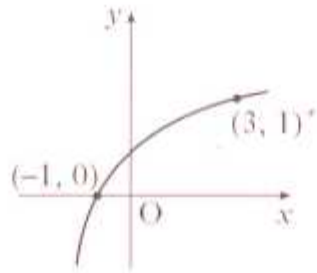
B  $x_J = 2, x_K = -2$

C  $x_J = 1, x_K = -2$

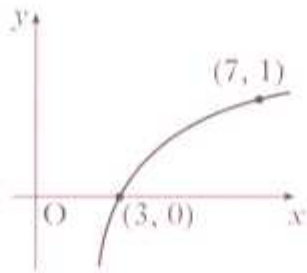
D  $x_J = -1, x_K = 2$

10. Which of the following graphs has equation  $y = \log_5(x - 2)$ ?

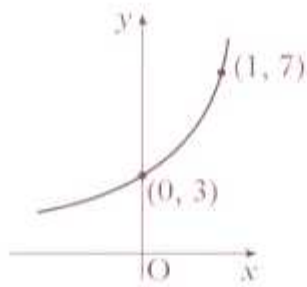
A



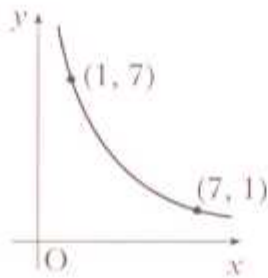
B



C



D



[Turn over

11. How many solutions does the equation

$$(4 \sin x - \sqrt{5})(\sin x + 1) = 0$$

have in the interval  $0 \leq x < 2\pi$ ?

- A 4
- B 3
- C 2
- D 1

12. A function  $f$  is given by  $f(x) = 2x^2 - x - 9$ .

Which of the following describes the nature of the roots of  $f(x) = 0$ ?

- A No real roots
- B Equal roots
- C Real distinct roots
- D Rational distinct roots

13.  $k$  and  $a$  are given by

$$k \sin a^\circ = 1$$

$$k \cos a^\circ = \sqrt{3}$$

where  $k > 0$  and  $0 \leq a < 90$ .

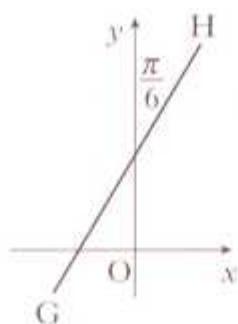
What are the values of  $k$  and  $a$ ?

	$k$	$a$
A	2	60
B	2	30
C	$\sqrt{10}$	60
D	$\sqrt{10}$	30

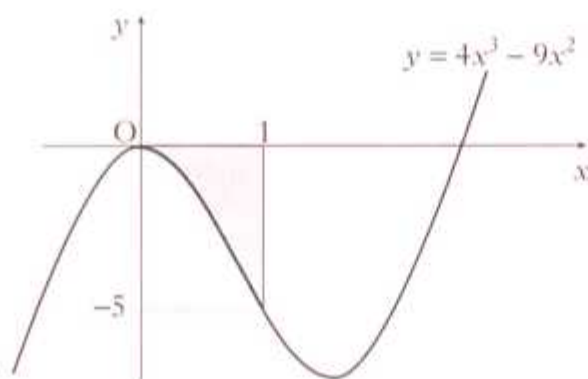
14. If  $f(x) = 2\sin\left(3x - \frac{\pi}{2}\right) + 5$ , what is the range of values of  $f(x)$ ?

- A  $-1 \leq f(x) \leq 11$
- B  $2 \leq f(x) \leq 8$
- C  $3 \leq f(x) \leq 7$
- D  $-3 \leq f(x) \leq 7$

15. The line GH makes an angle of  $\frac{\pi}{6}$  radians with the y-axis, as shown in the diagram. What is the gradient of GH?



- A  $\sqrt{3}$   
 B  $\frac{1}{2}$   
 C  $\frac{1}{\sqrt{2}}$   
 D  $\frac{\sqrt{3}}{2}$
16. The graph of  $y = 4x^3 - 9x^2$  is shown in the diagram. Which of the following gives the area of the shaded section?



- A  $\left[ x^4 - 3x^3 \right]_{-5}^0$   
 B  $-\left[ x^4 - 3x^3 \right]_0^1$   
 C  $\left[ 12x^2 - 18x \right]_{-5}^0$   
 D  $-\left[ 12x^2 - 18x \right]_0^1$

17. The vector  $\mathbf{u}$  has components  $\begin{pmatrix} -3 \\ 0 \\ 4 \end{pmatrix}$ .

Which of the following is a unit vector parallel to  $\mathbf{u}$ ?

A  $-\frac{3}{5}\mathbf{i} + \frac{4}{5}\mathbf{k}$

B  $-3\mathbf{i} + 4\mathbf{k}$

C  $-\frac{3}{\sqrt{7}}\mathbf{i} + \frac{4}{\sqrt{7}}\mathbf{k}$

D  $-\frac{1}{3}\mathbf{i} + \frac{1}{4}\mathbf{k}$

18. Given that  $f(x) = (4 - 3x^2)^{-\frac{1}{2}}$  on a suitable domain, find  $f'(x)$ .

A  $-3x(4 - 3x^2)^{-\frac{1}{2}}$

B  $-\frac{1}{2}(4 - 6x)^{-\frac{3}{2}}$

C  $2(4 - 3x^2)^{\frac{1}{2}}$

D  $3x(4 - 3x^2)^{-\frac{3}{2}}$

19. For what values of  $x$  is  $6 + x - x^2 < 0$ ?

A  $x > 3$  only

B  $x < -2$  only

C  $x < -2, x > 3$

D  $-3 < x < 2$

20.  $A = 2\pi r^2 + 6\pi r$ .

What is the rate of change of  $A$  with respect to  $r$  when  $r = 2$ ?

A  $10\pi$

B  $12\pi$

C  $14\pi$

D  $20\pi$

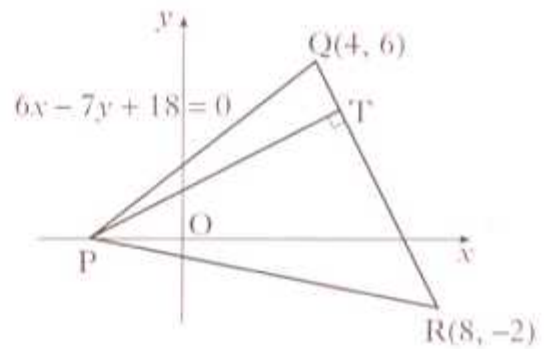
[END OF SECTION A]

SECTION B

ALL questions should be attempted.

Marks

21. Triangle PQR has vertex P on the  $x$ -axis, as shown in the diagram.  
Q and R are the points (4, 6) and (8, -2) respectively.  
The equation of PQ is  $6x - 7y + 18 = 0$ .

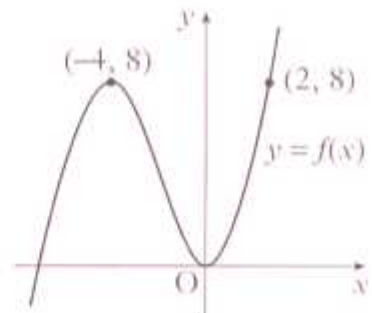


- (a) State the coordinates of P. 1
- (b) Find the equation of the altitude of the triangle from P. 3
- (c) The altitude from P meets the line QR at T. Find the coordinates of T. 4

22. D, E and F have coordinates (10, -8, -15), (1, -2, -3) and (-2, 0, 1) respectively.

- (a) (i) Show that D, E and F are collinear, 4  
(ii) Find the ratio in which E divides DF.
- (b) G has coordinates (k, 1, 0). 4  
Given that DE is perpendicular to GE, find the value of k.

23. The diagram shows a sketch of the function  $y = f(x)$ .



- (a) Copy the diagram and on it sketch the graph of  $y = f(2x)$ . 2
- (b) On a separate diagram sketch the graph of  $y = 1 - f(2x)$ . 3

[Turn over for Question 24 on Page twelve



- |  | <i>Mark</i> |
|--|-------------|
| 24. (a) Using the fact that $\frac{7\pi}{12} = \frac{\pi}{3} + \frac{\pi}{4}$ , find the exact value of $\sin\left(\frac{7\pi}{12}\right)$ . | 3           |
| (b) Show that $\sin(A + B) + \sin(A - B) = 2\sin A \cos B$ .   | 2           |
| (c) (i) Express $\frac{\pi}{12}$ in terms of $\frac{\pi}{3}$ and $\frac{\pi}{4}$ .   |             |
| (ii) Hence or otherwise find the exact value of $\sin\left(\frac{7\pi}{12}\right) + \sin\left(\frac{\pi}{12}\right)$ .                       | 4           |

[END OF SECTION B]

[END OF QUESTION PAPER]