SECTION A

ALL questions should be attempted.

1. A sequence is defined by the recurrence relation $u_{n+1} = 5 - 2u_n$, $u_0 = 3$.

   What is the value of u_2?

   A 1

   B 3

   C 5

   D 7

2. What is the equation of the line through the points $(1, -4)$ and $(3, -2)$?

   A $x - y - 5 = 0$

   B $x + y - 5 = 0$

   C $3x + 2y - 5 = 0$

   D $2x + 3y + 5 = 0$

3. If $f(x) = (2x - 1)(3x + 2)$, find $f'(x)$.

   A 6

   B $6x - 2$

   C $12x + 1$

   D $2x^3 - 2x$

4. $g(x) = x^3 - 3x + 5$

   What is the remainder when $g(x)$ is divided by $(x + 2)$?

   A -2

   B 0

   C 3

   D 7

5. The line with equation $kx - 3y + 7 = 0$ is parallel to the line with gradient 5.

What is the value of k?

A -5

B $-\frac{1}{5}$

C $\frac{1}{3}$

D 15

6. Find $\int 4\sqrt[3]{x}\, dx$

A $\frac{4}{3}x^{\frac{1}{3}} + c$

B $3x^{\frac{4}{3}} + c$

C $2x^{\frac{3}{2}} + c$

D $12x^4 + c$

7. A circle centre $(-2, -3)$ passes through the point $(1, 3)$.

What is the equation of the circle?

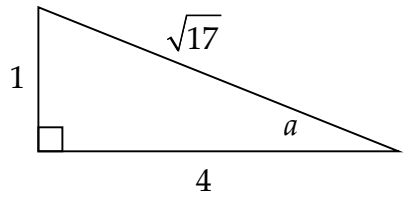
A $(x-2)^2 + (y-3)^2 = 1$

B $(x-2)^2 + (y-3)^2 = 45$

C $(x+2)^2 + (y+3)^2 = 1$

D $(x+2)^2 + (y+3)^2 = 45$

8. The diagram shows a right-angled triangle with sides of 1, 4, $\sqrt{17}$.



What is the value of $\sin 2a$?

A $\dfrac{2}{\sqrt{17}}$

B $\dfrac{8}{\sqrt{17}}$

C $\dfrac{8}{17}$

D $\dfrac{15}{17}$

9. Which of the following describes the stationary point on the curve with equation $y = 6 - 2(x+3)^2$?

A minimum at $(-3, 6)$

B maximum at $(-3, 6)$

C minimum at $(3, 6)$

D maximum at $(3, 6)$

10. A circle has equation $2x^2 + 2y^2 - 8x + 12y - 7 = 0.$

What is the centre of this circle?

A $(2, -3)$

B $(8, -12)$

C $(-8, 12)$

D $(-4, 6)$

11. What is the minimum value of $3 - 8\cos\left(x - \frac{2\pi}{7}\right)$?

A -8

B -5

C -1

D 0

12. Here are two statements about the function $f(x) = \sqrt{x-5}$.

(1) The largest possible domain is $x < 5$.

(2) The range is $f(x) \geq 0$.

Which of the following is true?

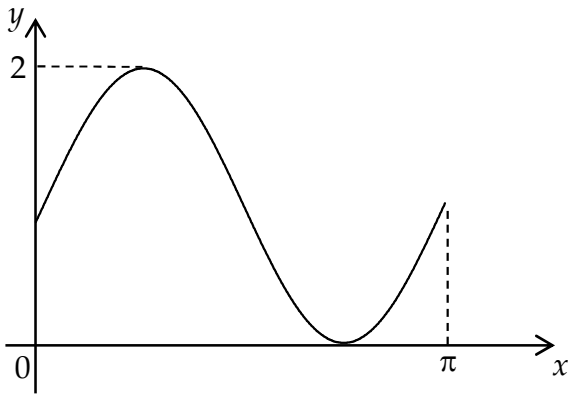
A Neither statement is correct.

B Only statement (1) is correct.

C Only statement (2) is correct.

D Both statements are correct.

13. The graph shown in the diagram has equation of the form $y = p + \sin(qx)$.



What are the values of p and q?

	p	q
A	1	1
B	2	1
C	1	2
D	2	2

14. The curve $y = f(x)$ is such that $\frac{dy}{dx} = 4 - 3x^2$ and the curve passes through the origin.

What is the equation of the curve?

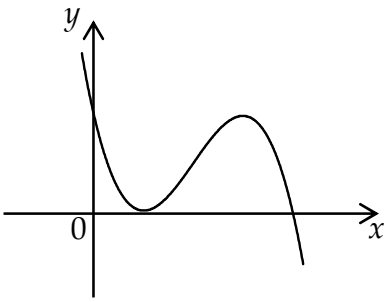
A $y = x^3$

B $y = 4 - 6x^3$

C $y = 4x - x^3$

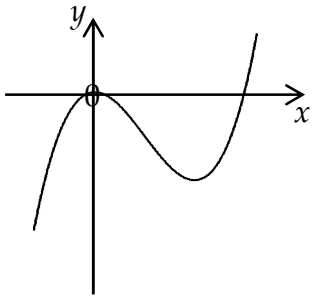
D $y = -6x$

15. The diagram shows the graph of $y = f(x)$.



Which diagram below shows the graph of $y = -2 - f(x)$?

A



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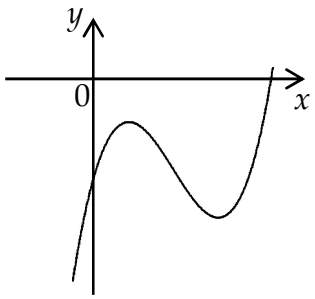

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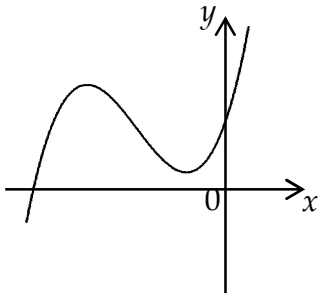

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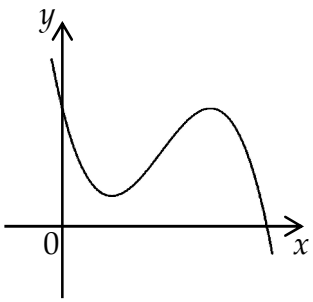
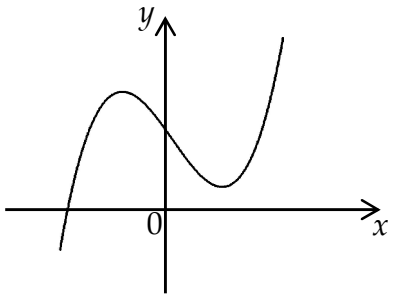
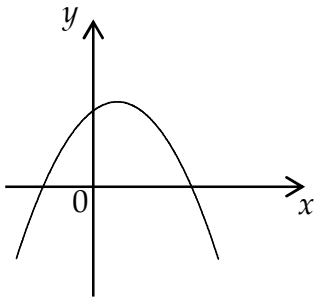


16. The diagram shows the graph of $y = f(x)$.



Which diagram below shows the graph of $y = f'(x)$?

A



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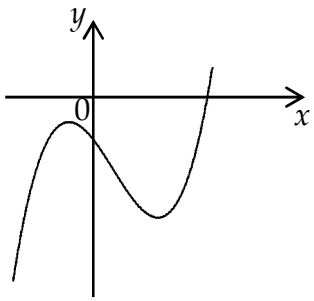

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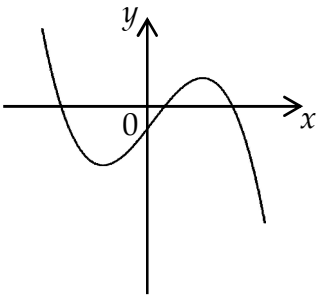

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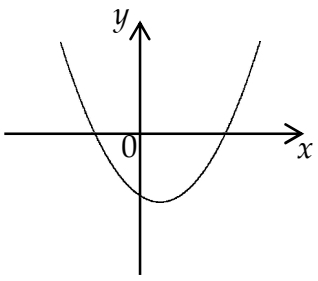


17. What is the exact value of $\sin\frac{\pi}{4}-\cos\frac{2\pi}{3}$?

A $\frac{1}{2}$

B $\frac{1}{2}+\frac{1}{\sqrt{2}}$

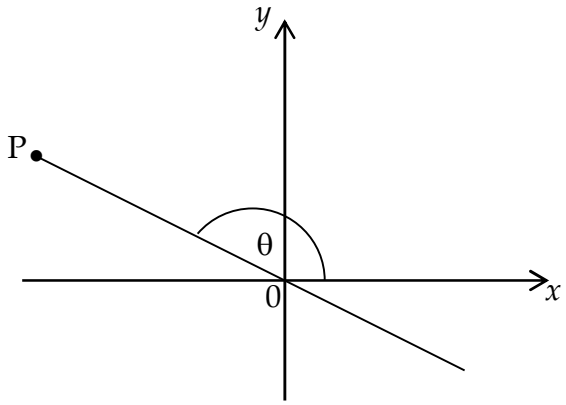
C $1+\frac{\sqrt{3}}{2}$

D $\frac{\sqrt{3}}{2}-\frac{1}{\sqrt{2}}$

18. The diagram shows the line OP with equation $3x+y=0$.

The angle between OP and the positive direction of the x-axis is θ.

Find an expression for the gradient of OP.



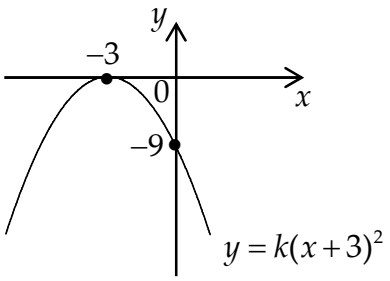
A $\tan^{-1}\frac{1}{3}$

B $-\tan^{-1}\frac{1}{3}$

C $\tan^{-1}3$

D $-\tan^{-1}3$

19. The equation of the parabola shown is of the form $y = k(x+3)^2$.



What is the value of k?

A -9

B -1

C 1

D 9

20. What is the solution to $6 - x - x^2 < 0$?

A $-2 < x < 3$

B $x < -1$ or $x > 6$

C $x < -3$ or $x > 2$

D $-6 < x < 1$

SECTION B

ALL questions should be attempted.

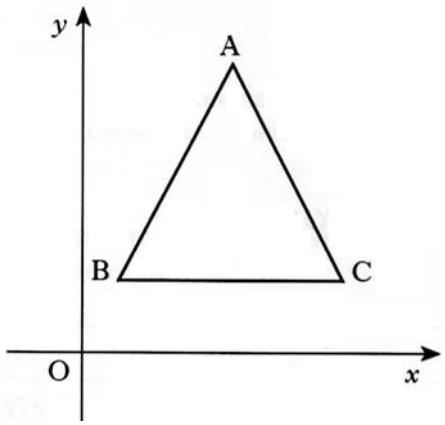
Marks

21. The graph of the curve with equation $y = 2x^3 + x^2 - 13x + a$ crosses the x-axis at the point $(2, 0)$.

(a) Find the value of a and hence write down the coordinates of the point at which this curve crosses the y-axis. **3**

(b) Find the coordinates of the other points at which the curve crosses the x-axis. **4**

22. A triangle ABC has vertices A(4, 8), B(1, 2) and C(7, 2).



(a) Show that the triangle is isosceles **2**

(b) (i) The altitudes AD and BE intersect at H, where D and E lie on BC and CA respectively. Find the coordinates of H.

(ii) Hence show that H lies one quarter of the way up DA. **8**

23. (a) $f(x) = 2x + 1$, $g(x) = x^2 + k$, where k is a constant.

(i) Find $g(f(x))$;

(ii) find $f(g(x))$. **2**

(b) (i) Show that the equation $g(f(x)) - f(g(x)) = 0$ simplifies to $2x^2 + 4x - k = 0$.

(ii) Determine the nature of the roots of this equation when $k = 6$.

(iii) Find the value of k for which $2x^2 + 4x - k = 0$ has equal roots. **7**

24. Two sequences are defined by the recurrence relations

$$u_{n+1} = 0 \cdot 2u_n + p, \quad u_0 = 1$$
$$v_{n+1} = 0 \cdot 6v_n + q, \quad v_0 = 1$$

If both sequences have the same limit, express p in terms of q. **4**

End of Section B

End of question paper