Higher Mathematics
Multiple choice questions 2

1. Triangle ABC has vertices A(-2,-5), B(-7,5) and C (1,1). AD is a median. The gradient of AD is

A $-\frac{1}{2}$ B 2 C –8 D 8

2. Here are two statements about the points P(1,-2) and Q(7,6).
   (i) The length of PQ is 10 units
   (ii) The gradient of PQ is $\frac{3}{4}$

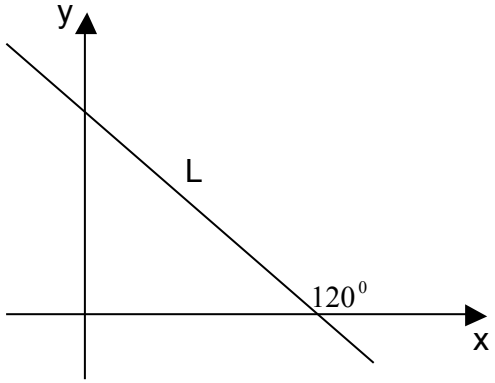
   Which of the following is true

   A Neither statement is true
   B Only statement (i) is true
   C Only statement (ii) is true
   D Both statements are true

3. A line L is perpendicular to the line $2x – 5y – 8 = 0$.
   What is the gradient of the line L?

A $\frac{2}{5}$ B $-\frac{2}{5}$ C 2 D $-\frac{5}{2}$

4. The diagram shows a line L; the angle between L and the positive direction of the x-axis is 120^0, as shown.



   The gradient of L is

A $\sqrt{3}$ B $-\sqrt{3}$ C $\frac{1}{\sqrt{3}}$ D $-\frac{1}{\sqrt{3}}$

5. A recurrence relation is defined as $u_{n+1} = 0.2u_n + 90$, $u_6 = 50$.
   What is the value of u_8?

A 110 B 100 C 112 D 118

6. A sequence is generated by the recurrence relation $u_{n+1} = 0.6u_n - 80$.
The limit of this sequence is

A $-\frac{400}{3}$ B -200 C -800 D 200

7. $f(x) = 2x^2 - 5$ and $g(x) = 2x - 1$. The value of $g(f(-3))$ is

A 25 B 61 C 93 D 45

8. Functions f and g are defined on suitable domains by $f(x) = \sin x$ and $g(x) = x - \frac{\pi}{3}$
The value of $f(g(\frac{\pi}{2}))$ is

A $\frac{1}{2}$ B $\frac{\sqrt{3}}{2}$ C $\frac{1}{2} - \frac{\pi}{3}$ D 1

9. $f(x) = \dfrac{x-1}{(x+3)(x-2)}$. A suitable domain for f(x) is

A $x \in R, x \neq 1$ B $x \in R, x \neq 1, -3, 2$ C $x \in R, x \neq -3, 2$ D $x \in R, x \neq 3, -2$

10. What is the derivative of $(3x - 5)^4$

A $4(3x-5)^3$ B $12(3x-5)^3$ C $\dfrac{(3x-5)^5}{5}$ D $\dfrac{(3x-5)^5}{15}$

11. A curve has equation $y = 3x^2 - 5x$. The gradient of this curve at the point (-1,8) is

A 1 B –11 C –6 D 4

12. A curve has equation $y = 2x^2 - 8x$. The gradient of this curve at the point P is 4.
The coordinates of P are

A (3,6) B (3,-6) C (4,0) D (-1,10)

13. What is the derivative of $\dfrac{1}{3x^2}$.

A $-\dfrac{6}{x^3}$ B $-\dfrac{1}{x^3}$ C $-\dfrac{2}{3x^3}$ D $-\dfrac{1}{6x^3}$

14. $A = 3\pi r^2 - 4\pi r$. The rate of change of A with respect to r when r = 4 is

A 20π B 32π C 24π D 8π

15. The derivative of a function is $f'(x) = x^3 - 8$. Here are two statements about f:

(i) f is increasing at x = 1
(ii) f is stationary at x = 2

Which of the following is true?

A Neither statement is correct
B Only statement (i) is correct
C Only statement (ii) is correct
D Both statements are correct

16. $x^2 - 6x + 1$ is expressed in the form $(x + a)^2 + b$. The values of a and b are

A a = 3, b = 8 B a = -3, b = -10 C a = -3, b = -8 D a = -3, b = 10

17. $3x^2 + 12x - 2$ is expressed in the form $p(x + q)^2 + r$. The value of r is

A -6 B 6 C -14 D -10

18. $2\cos x + \sqrt{3} = 0$. The solution to this equation when $\pi \le x \le \frac{3\pi}{2}$

A $\frac{2\pi}{3}$ B $\frac{4\pi}{3}$ C $\frac{5\pi}{6}$ D $\frac{7\pi}{6}$

19. Given $0 \le a \le \frac{\pi}{2}$ and $\sin a = \frac{1}{2}$, the exact value of cos 2a is

A $\frac{1}{2}$ B $-\frac{1}{2}$ C $-\frac{\sqrt{3}}{2}$ D $\frac{3}{2}$

20. $f(x) = 3\sin\left(2x - \frac{2\pi}{3}\right) + 8$. The range of values of f(x) are

A $0 \le f(x) \le 11$ B $-3 \le f(x) \le 5$ C $3 \le f(x) \le 11$ D $5 \le f(x) \le 11$

21. How many solutions does the equation $(2\sin x + 1)(\sin x + 1) = 0$ have in the range $\frac{\pi}{2} \le x \le \frac{3\pi}{2}$

A 1 B 2 C 3 D 4

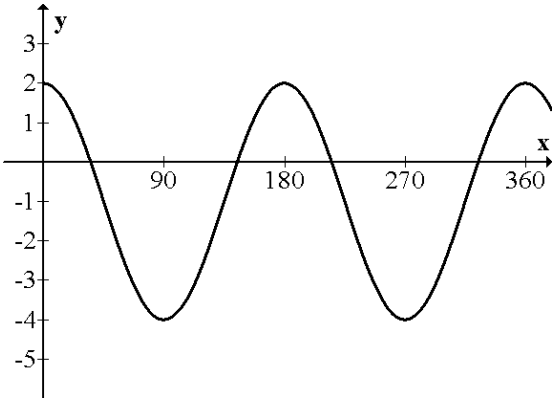
22. k and a are given by

$k \sin a = \sqrt{3}$
$k \cos a = 1$

where $k > 0$ and $0 \le a \le 90$. The values of k and a are

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

23. The diagram shows a graph of the form $y = a\cos bx + c$.



The equation of this graph is

A $y = 3\cos x - 1$ B $y = 3\cos 2x - 1$ C $y = 2\cos 2x - 2$ D $y = 6\cos 2x - 4$

24. Here are two statements about the roots of the equation $x^2 - 8x + 12 = 0$.

(i) The roots are real and rational
(ii) The roots are equal

Which of the following is true?

A Neither statement is correct
B Only statement (i) is correct
C Only statement (ii) is correct
D Both statements are correct

25. A function f is given by $f(x) = 2x^2 - 12x + 8$.
Which of the following describes the roots of $f(x) = 0$.

A The roots are unreal
B The roots are equal
C The roots are rational and distinct
D The roots are real and distinct

26. The y-axis is a tangent to the circle with centre (-4,7). The equation of this circle is

A $(x - 4)^2 + (y + 7)^2 = 16$ B $(x + 4)^2 + (y - 7)^2 = 16$

C $(x - 4)^2 + (y + 7)^2 = 49$ D $(x - 4)^2 + (y + 7)^2 = 16$

27. A circle has equation $x^2 + y^2 - 6x + 8y - 39 = 0$. The radius of this circle has length

A 64 B 8 C $\sqrt{139}$ D $\sqrt{46}$

28. A circle has centre (-2,4) and a tangent to the circle is drawn at the point (4,7). The gradient of this tangent is

A 2 B –2 C $-\frac{1}{2}$ D $\frac{1}{2}$

29. The line $y = 2x - 5$ intersects the circle $x^2 + y^2 = 10$ at two points. The x-coordinates of the points of intersection are

A $x = 2, -2$ B $x = -1, -3$ C $x = 1, 3$ D $x = -1, 1$

30. The vectors $\mathbf{u} = 2\mathbf{i} - 4\mathbf{k}$ and $\mathbf{v} = 6\mathbf{i} - 4\mathbf{j} + a\mathbf{k}$ are perpendicular. The value of a is

A 3 B –3 C 2 D –2

31. A(2,-1,3), E(4,-5,9) and B(7,-11,18) are three collinear points. E lies between A and B. The ratio in which E divides AB is

A 1:2 B 2:3 C 3:2 D 2:1

32. Vectors **u** and **v** are such that $|\mathbf{u}| = 4$ and $|\mathbf{v}| = 6$ and $\mathbf{u}.\mathbf{v} = 10$. The value of $\mathbf{v}.(\mathbf{u} + \mathbf{v})$ is

A 20 B 26 C 46 D 60

33. The vector **a** has components $\begin{pmatrix} -6 \\ -8 \\ 0 \end{pmatrix}$. A unit vector parallel to **a** is

A $-\frac{3}{5}\mathbf{i} - \frac{4}{5}\mathbf{j}$ B $-\frac{4}{5}\mathbf{i} + \frac{3}{5}\mathbf{j}$ C $-6\mathbf{i} - 8\mathbf{j}$ D $-\frac{3}{50}\mathbf{i} - \frac{4}{50}\mathbf{j}$

34. For what values of x is $x^2 + 6x < 0$

A $x < -6, x > 0$ B $x < 0, x > 6$ C $-6 < x < 0$ D $0 < x < 6$

35. For what values of x is $7x - x^2 - 6 > 0$

A $x < 1, x > 6$ B $x < -6, x > -1$ C $-6 < x < -1$ D $1 < x < 6$

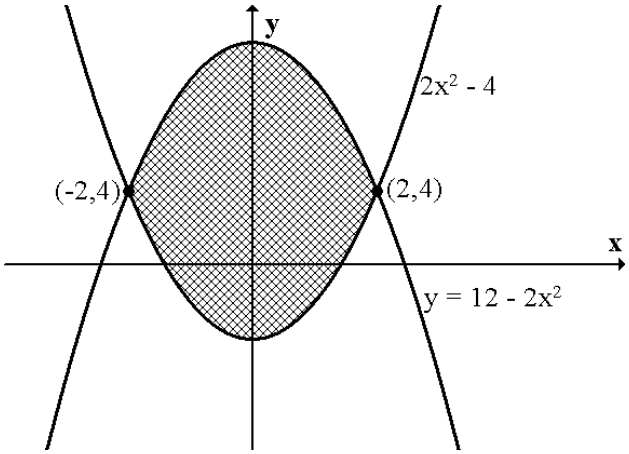
36. Given $f(x) = 2\sin^2 x$, $f'(x)$ is equal to

A $4\cos x$ B $4\cos^2 x$ C $4\sin x \cos x$ D $2\sin^3 x$

37. Find $\int 4\cos(2x + 3)\,dx$.

A $4\sin(2x + 3) + C$ B $-4\sin(2x + 3) + C$ C $2\sin(2x + 3) + C$ D $-2\sin(2x + 3) + C$

38. The shaded area shown opposite is given by



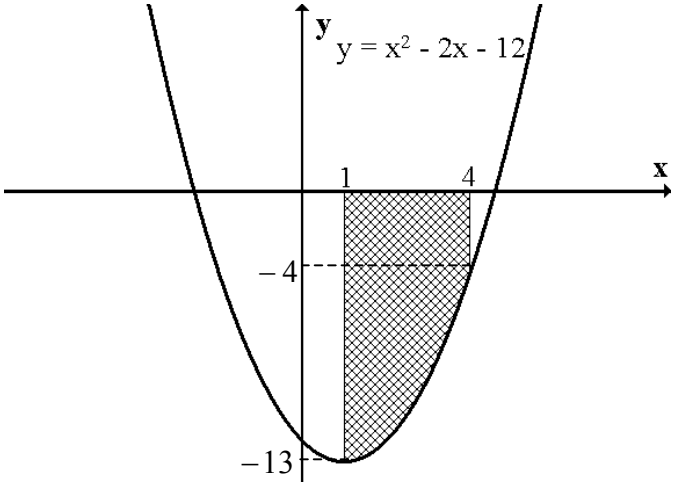
A $\int_{-2}^{2} (2x^2 - 4) - (12 - 2x^2)\,dx$

B $\int_{-2}^{4} (2x^2 - 4) - (12 - 2x^2)\,dx$

C $\int_{-2}^{2} (12 - 2x^2) - (2x^2 - 4)\,dx$

D $\int_{-2}^{4} (12 - 2x^2) - (2x^2 - 4)\,dx$

39. The diagram shows the graph of $y = x^2 - 2x - 12$.



The shaded area is given by

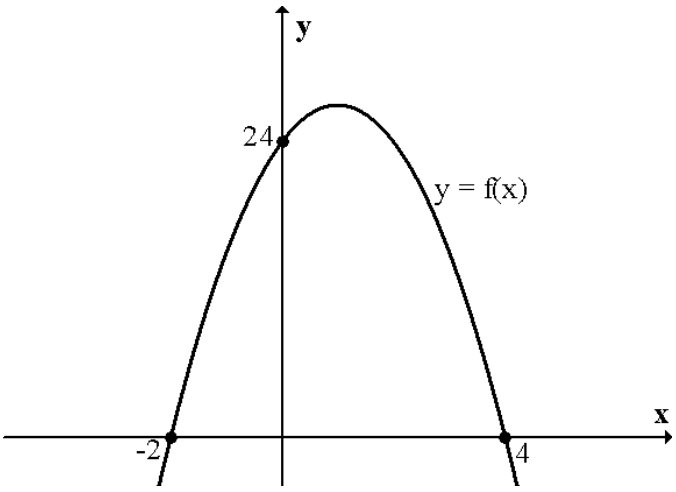
A $\left[\frac{1}{3}x^3 - x^2 - 12x\right]_1^4$

B $\left[\frac{1}{3}x^3 - x^2 - 12x\right]_{-13}^{-4}$

C $\left[2x - 2\right]_1^4$

D $\left[2x - 2\right]_{-13}^{-4}$

40. The diagram shows the graph of $y = f(x)$. The graph has an equation of the form $y = k(x + a)(x + b)$.



The equation of this graph is

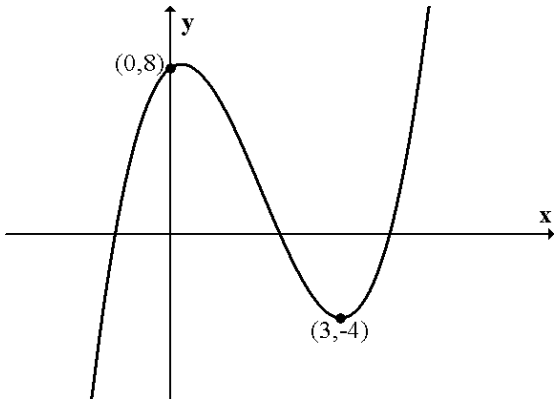
A $y = 3(x + 2)(x - 4)$

B $y = -3(x + 2)(x - 4)$

C $y = -3(x - 2)(x + 4)$

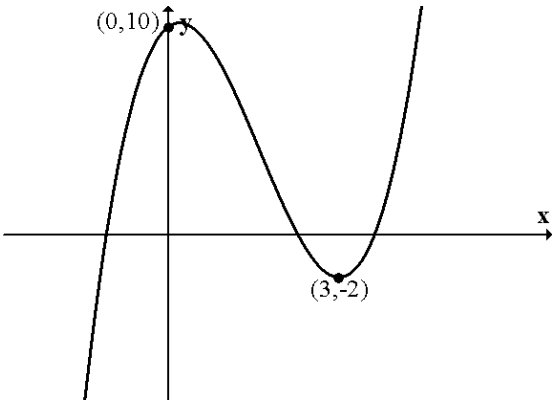
D $y = 3(x - 2)(x + 4)$

41. The diagram opposite shows part of the graph of $y = f(x)$.

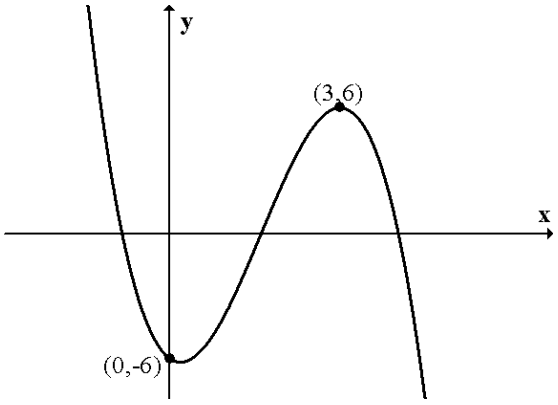


Which of the following shows the graph of $y = -f(x + 2)$.

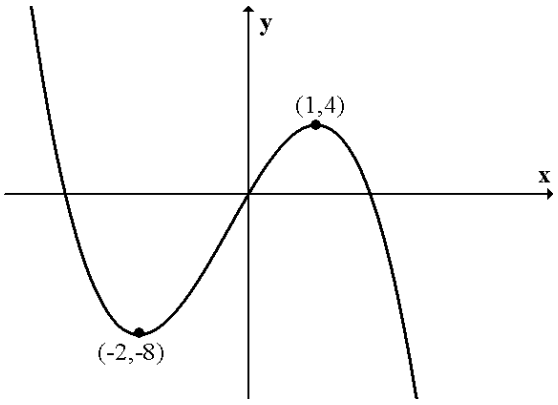
A



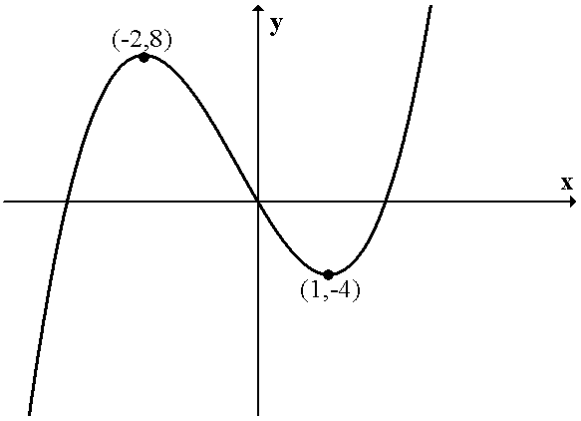
B



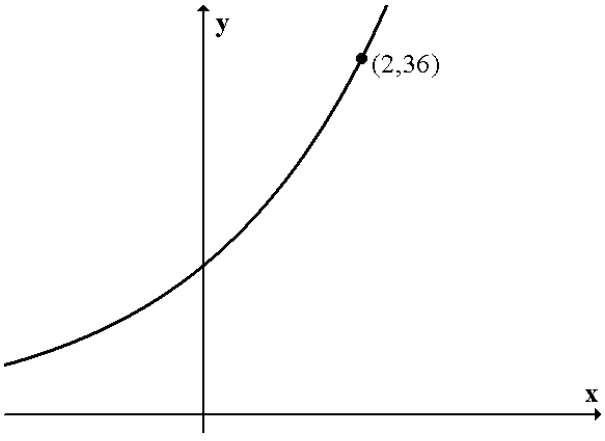
C



D



42. The diagram shows part of the graph of $y = 4k^x$.



The value of k is

A 3

B 2

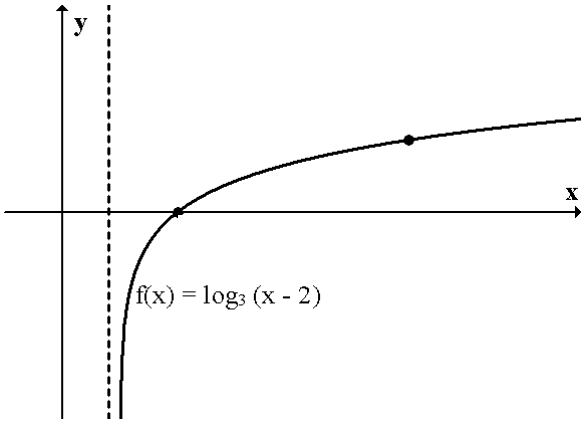
C 9

D 18

43. The exact value of $4\sin\frac{\pi}{3}\cos\left(-\frac{\pi}{3}\right)$ is

A -1 B 3 C -3 D $\sqrt{3}$

44. The diagram shows the graph of $f(x) = \log_3 (x - 2)$.
The point (c,2) lies on this graph.

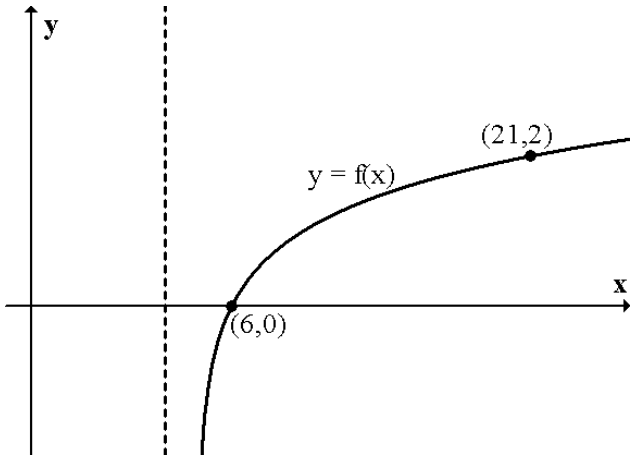


The value of c is

A 10 B 11

C 5 D 6

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



The equation of f(x) is

A $f(x) = \log_4 (x - 5)$

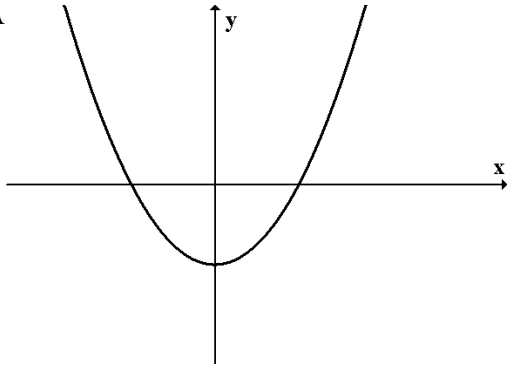
B $f(x) = \log_4 (x + 5)$

C $f(x) = \log_2 (x - 5)$

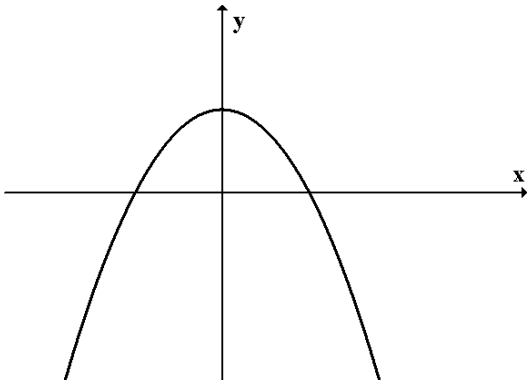
D $f(x) = \log_2 (x + 5)$

46. Which of the following shows a parabola with equation $y = ax^2 + bx + c$, where $a < 0$ and $b^2 - 4ac = 0$.

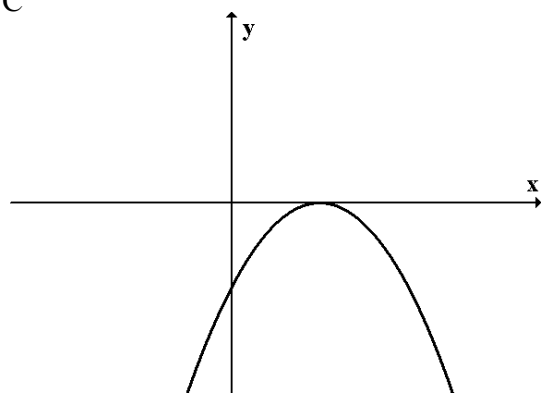
A



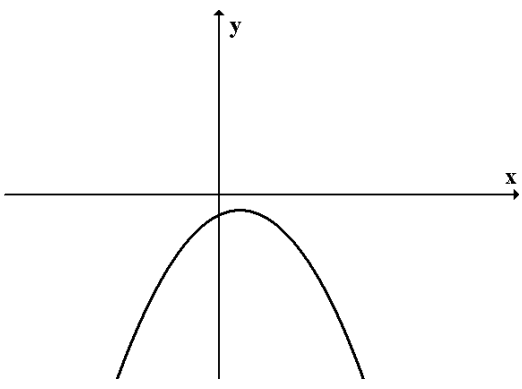
B



C



D



47. $x - 2$ is a factor of $x^3 - 9x + k$. The value of k is

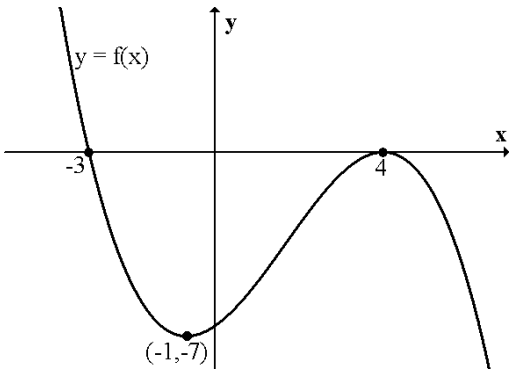
A 13 B –13 C 10 D –10

48. $\frac{1}{2}\log_2 36 - \log_2 3$ is equal to

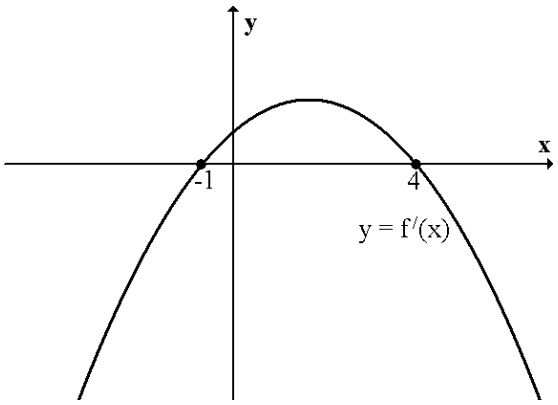
A 3 B 1 C 0 D 6

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

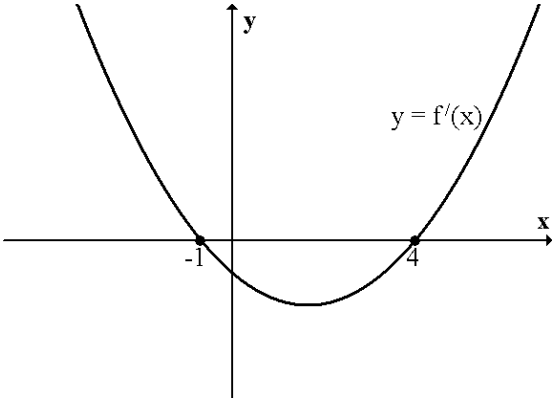
Which of the following could be the graph of $y = f'(x)$.



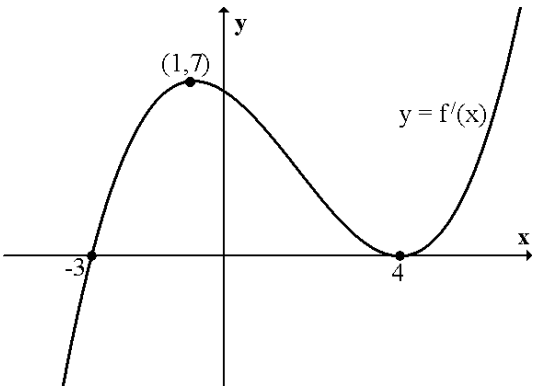
A



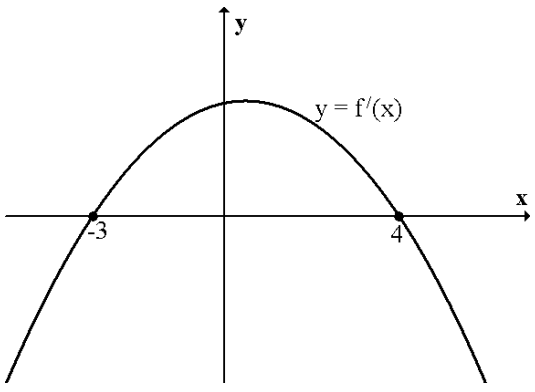
B



C



D

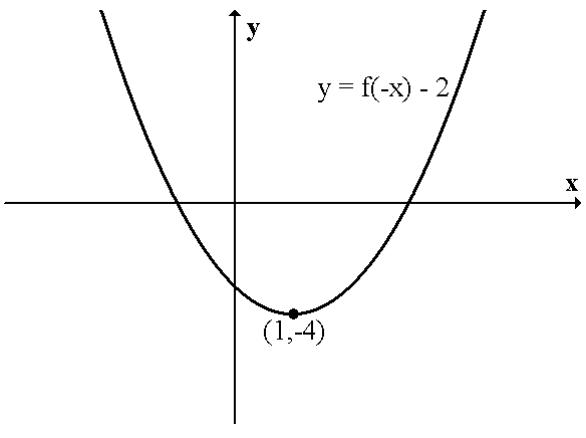


50. The diagram shows the graph of $y = f(-x) - 2$.

The graph of $y = f(x)$ has a stationary point at

A (-1,4) B (-1,-2)

C (-1,0) D (-1,-4)



Answers:

1.	C		26.	B
2.	B		27.	B
3.	D		28.	B
4.	B		29.	C
5.	A		30.	A
6.	B		31.	B
7.	A		32.	C
8.	A		33.	A
9.	C		34.	C
10.	B		35.	D
11.	B		36.	C
12.	B		37.	C
13.	C		38.	C
14.	A		39.	A
15.	C		40.	B
16.	C		41.	C
17.	C		42.	A
18.	D		43.	D
19.	A		44.	B
20.	D		45.	A
21.	B		46.	C
22.	A		47.	C
23.	B		48.	B
24.	B		49.	A
25.	D		50.	B