AGA KHAN UNIVERSITY EXAMINATION BOARD

HIGHER SECONDARY SCHOOL CERTIFICATE

CLASS XII

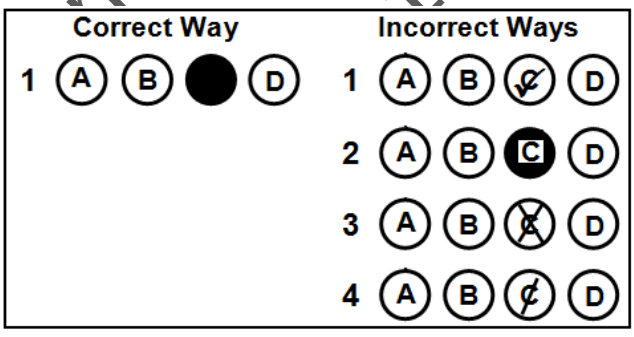
ANNUAL EXAMINATIONS 2022

Mathematics

Time: 2 hours 10 minutes Marks: 65

INSTRUCTIONS

1. Read each question carefully.
2. Answer the questions on the separate answer sheet provided. DO NOT write your answers on the question paper.
3. There are 100 answer numbers on the answer sheet. Use answer numbers 1 to 65 only.
4. In each question, there are four choices A, B, C, D. Choose ONE. On the answer grid, black out the circle for your choice with a pencil as shown below.



Candidate's Signature

5. If you want to change your answer, ERASE the first answer completely with a rubber, before blacking out a new circle.
6. DO NOT write anything in the answer grid. The computer only records what is in the circles.
7. The marks obtained on the 65 MCQs will be equated to the total marks of 100 for the theory examination results.
8. You may use a scientific calculator if you wish.

1. If $g(x) = x^2$, then the value of $g(g(-1))$ is equal to

   A. -4
   B. -1
   C. 1
   D. 4

2. The range of the function $f(x) = \sqrt{(5-x)(5+x)}$ is

   A. $(0,5)$.
   B. $\{0,5\}$.
   C. $[0,5]$.
   D. $R - \{0,5\}$.

3. Which of the following functions is an odd function?

   A. $f(x) = -x^2$
   B. $f(x) = (-x)^2$
   C. $f(x) = -x^3 + 3$
   D. $f(x) = -x^3 + 3x$

4. The value of $\lim\limits_{x \to -2} \dfrac{x^2 - 4}{(x-2)^2}$ is

   A. 0
   B. 2
   C. 4
   D. undefined

5. The value of $\lim\limits_{x \to 0} \dfrac{\sin 3x}{x}$ is

   A. 0
   B. 3
   C. $\dfrac{1}{3}$
   D. undefined

6. For the real valued function $f(x) = x^2$, where $x \in R$, the inverse function

A. is $f^{-1}(x) = -x^2$.
B. is $f^{-1}(x) = \pm\sqrt{x}$.
C. is $f^{-1}(x) = \sqrt{x}$.
D. does not exist.

7. At $y = 0$, the value(s) of x for $y = \sqrt{x^2 - 14x + 49}$ is/ are

A. -7
B. 0
C. 7
D. ± 7

8. If $f(x) = x - 1$ and $g(x) = x + 1$, then $(fog)(x)$ will be

A. x
B. 2
C. $2x$
D. $x^2 - 1$

9. If $f(x) = \frac{x^5}{a}$, then the third derivative with respect to x i.e., $f'''(x)$ is

A. $\frac{60x^2}{a}$.
B. $\frac{60x^2}{a^2}$.
C. $\frac{20x^3}{a^2}$.
D. $\frac{20x^3}{a}$.

10. The derivative of $\cos^{-1} x$ is

A. $-\frac{1}{\sqrt{1+x^2}}$.
B. $-\frac{1}{\sqrt{1-x^2}}$.
C. $\frac{1}{\sqrt{1+x^2}}$.
D. $\frac{1}{\sqrt{1-x^2}}$.

11. If $y = x^3 - 5$, then $\frac{d^3y}{dx^3}$ is equal to

A. 0
B. 6
C. x
D. $2x$

12. On differentiating $y = x\sin y$, with respect to x, we get

A. $\frac{dy}{dx} = \frac{\sin y}{1 - x\cos y}$.
B. $\frac{dy}{dx} = -\frac{\sin y}{1 - x\cos y}$.
C. $\frac{dy}{dx} = \frac{\sin y}{1 + x\cos y}$.
D. $\frac{dy}{dx} = -\frac{\sin y}{1 + x\cos y}$.

13. The derivative of $\frac{1}{\sqrt{x - a^2}}$, with respect to x, is

A. $-a\left(x - a^2\right)^{-\frac{3}{2}}$
B. $-a\left(x - a^2\right)^{-\frac{1}{2}}$
C. $-\frac{1}{2}\left(x - a^2\right)^{-\frac{1}{2}}$
D. $-\frac{1}{2}\left(x - a^2\right)^{-\frac{3}{2}}$

14. If $y = xe^x$, then $\frac{dy}{dx}$ will be

A. e^x.
B. x^2e^{x-1}.
C. $e^x + xe^x$.
D. $e^x + x^2e^{x-1}$.

15. If $xy - y = 0$, then $\frac{dy}{dx}$ will be

A. $\frac{y}{x+1}$.

B. $\frac{y}{x-1}$.

C. $-\frac{y}{x-1}$.

D. $-\frac{y}{x+1}$.

16. If $y = \text{cosec}^2\theta$, then $\frac{dy}{d\theta}$ will be

A. $-2\text{cosec}^2\theta\cot\theta$.

B. $2\text{cosec}^2\theta\cot\theta$.

C. $-2\text{cosec}\,\theta\cot\theta$.

D. $2\text{cosec}\,\theta\cot\theta$.

17. For the curve $y = 2x^2 + 1$, the slope of tangent at the point (1, 1) will be

A. $-\frac{1}{4}$

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

C. 4

D. 5

18. If $f(x) = \sin^2 x$, then the second derivative of $f(x)$ will be

A. $2\sin 2x$.

B. $2\cos 2x$.

C. $-2\sin 2x$.

D. $2\sin x\cos x$.

19. If $y = \ln e^{\tan x}$, then $\frac{dy}{dx}$ will be

A. $\sec^2 x$.

B. $\frac{\sec^2 x}{e^{\tan x}}$.

C. $\tan x \ln e^{\tan x - 1}$.

D. $\tan x \ln e^{\tan x - 1}\sec^2 x$.

20. The function $y = bx - \frac{x^2}{2}$ has an extreme value at

A. $x = -2b.$
B. $x = 2b.$
C. $x = b.$
D. $x = -b.$

21. To resolve $\frac{x^2 - 6x + 7}{\left(x^2 + a\right)\left(x^2 - b^2\right)^2}$ into its partial fractions, the appropriate form will be

A. $\frac{Ax + B}{\left(x^2 + a\right)} + \frac{Cx + D}{x^2 - b^2}.$
B. $\frac{Ax + B}{\left(x^2 + a\right)} + \frac{C}{x - b} + \frac{D}{x + b}.$
C. $\frac{Ax + B}{\left(x^2 + a\right)} + \frac{Cx + D}{\left(x^2 - b^2\right)} + \frac{Ex + F}{\left(x^2 - b^2\right)^2}.$
D. $\frac{Ax + B}{\left(x^2 + a\right)} + \frac{C}{x - b} + \frac{D}{(x - b)^2} + \frac{E}{x + b} + \frac{F}{(x + b)^2}.$

22. $\int \frac{dx}{\sqrt{a^2 - x}}$ is equal to

A. $\frac{1}{a}\sin^{-1}\frac{x}{a} + C.$
B. $\frac{1}{2}\sqrt{a^2 - x} + C.$
C. $-\sqrt{a^2 - x} + C.$
D. $-2\sqrt{a^2 - x} + C.$

23. $\int \sqrt{x - b^2}\, dx$ is equal to

A. $\frac{3}{2}\sqrt{\left(x - b^2\right)^3} + C.$
B. $\frac{2}{3}\sqrt{\left(x - b^2\right)^3} + C.$
C. $-\frac{2}{3}\sqrt{\left(x - b^2\right)^3} + C.$
D. $-\frac{3}{2}\sqrt{\left(x - b^2\right)^3} + C.$

24. $\int \frac{e^x}{1-e^x}\,dx$ is equal to

A. $(1-e^x)+C.$
B. $-(1-e^x)+C.$
C. $\ln(1-e^x)+C.$
D. $-\ln(1-e^x)+C.$

25. The value of $\int_{b}^{-b} dx$ is equal to

A. -2
B. $-2b$
C. 0
D. $2b$

26. The value of $\int_{-1}^{1} \frac{1}{x^3}\,dx$ is equal to

A. -1
B. 0
C. 1
D. 2

27. The solution of the differential equation $2\frac{dy}{dx} = \frac{\sqrt{x}}{y}$ is

A. $2\ln y = \frac{3}{2}x^{\frac{3}{2}} + C.$
B. $\frac{1}{2}\ln y = \frac{2}{3}x^{\frac{3}{2}} + C.$
C. $y^2 = \frac{1}{3}x^{\frac{3}{2}} + C.$
D. $y^2 = \frac{2}{3}x^{\frac{3}{2}} + C.$

28. The order and degree of the differential equation $x\cos y\left(\frac{dy}{dx}\right)^2 + \left(\frac{d^2y}{dx^2}\right) = 1$, respectively, are

A. 1 and 1
B. 1 and 2
C. 2 and 1
D. 2 and 2

29. $\int_{-2}^{2} \frac{dx}{4+x^2}$ is equal to

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

B. $-\frac{\pi}{2}$.

C. $\frac{\pi}{2}$.

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

30. The area under the graph of $f(x)=2x+1$, between $x=0$ and $x=1$, is

A. 1 unit.
B. 2 units.
C. 3 units.
D. $\frac{3}{2}$ units.

31. Consider a real valued function $f(x)$ which is defined and bounded in the interval $[a,c]$. Let b be a point belongs to the interval $[a,c]$. If $\int_a^b f(x)dx = s$ and $\int_b^c f(x)dx = t$, then $\int_a^c f(x)dx$ will be equal to

A. $s \div t$.
B. $s - t$.
C. $s \times t$.
D. $s + t$.

32. The solution of the differential equation $\frac{dy}{dx} = \frac{a}{b}x$ is

A. $y = \frac{a}{2b}x^2 + C$.

B. $y = \frac{b}{2a}x^2 + C$.

C. $y^2 = \frac{a}{b}x^2 + C$.

D. $y^2 = \frac{b}{a}x^2 + C$.

33. The *y*-coordinate of the point dividing the line segment joining the points A (2, 0) and B (0, 5) internally in the ratio 1:3 is

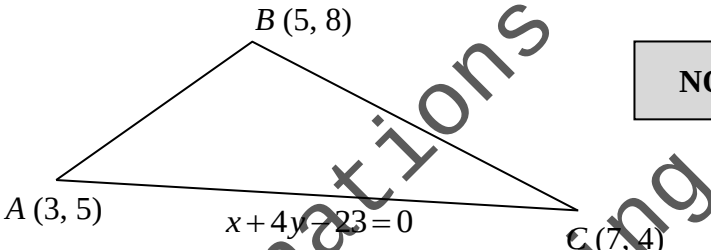
A. $\frac{5}{4}$.

B. $\frac{15}{4}$.

C. $-\frac{5}{2}$.

D. $-\frac{15}{2}$.

34. In the given figure, the length of altitude from vertex *B* to the side *AC* is



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A. $\frac{14}{\sqrt{89}}$.

B. $\frac{14}{\sqrt{17}}$.

C. $\frac{5}{\sqrt{17}}$.

D. $\frac{5}{\sqrt{89}}$.

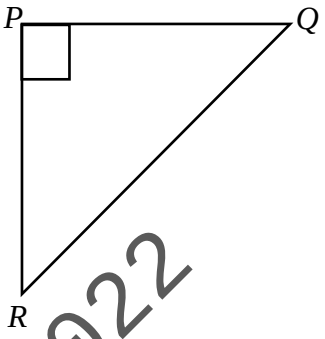
35. Which of the following points lies below the line $x - 3y + 2 = 0$?

A. (0, 5).
B. (1, 1).
C. (5, –1).
D. (– 5, –1).

36. The two parallel lines *l* and *m* are given as $3y = 6$ and $y = a$ respectively. If the perpendicular distance between *l* and *m* is 18 units, then one of the values of *a* will be

A. 16
B. 12
C. –12
D. –16

37. In the given right angled triangle *QPR*, the line *PR* is parallel to *y*-axis. If the slope of the line *QR* is 5, then the measure of $\angle R$ is



A. $\tan^{-1}\left(-\frac{1}{5}\right)$.

B. $\tan^{-1}(-5)$.

C. $\tan^{-1}\left(\frac{1}{5}\right)$.

D. undefined.

38. If $ax+y+c=0$ is parallel to $x+2y+3=0$, then the value of a will be

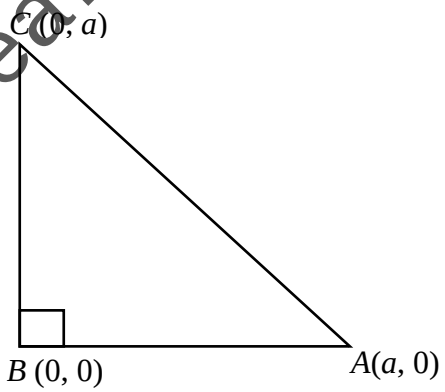
A. $-\frac{1}{2}$

B. $\frac{1}{2}$

C. 1

D. 2

39. The given diagram shows a right isosceles triangle *ABC* and the side *BC* is parallel to *y*-axis. The slope of hypotenuse of the given triangle is



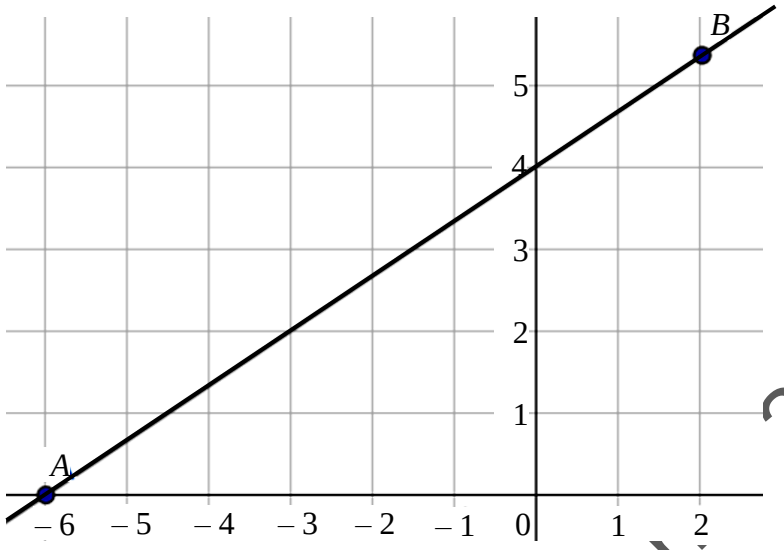
A. -1

B. $-\frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{2}}$

D. 1

40. The y-intercept of the line AB in the given graph is



A. -6
B. -4
C. 4
D. 6

41. The slope intercept form of the equation $y-a=\frac{1}{a}(x-a)$ is

A. $y=ax-1+a.$
B. $y=ax-1-a.$
C. $y=\frac{1}{a}x-1-a.$
D. $y=\frac{1}{a}x-1+a.$

42. The general form of the equation $x-3=\frac{1}{3}(y-3)$ is

A. $3x+y-6=0$
B. $3x-y-6=0$
C. $y=3x+6$
D. $y=-3x+6$

43. The equation of the line passing through the origin and parallel to the line $2x+y=3$ is

A. $2x+y=0$
B. $2x-y=0$
C. $x-2y=0$
D. $x+2y=0$

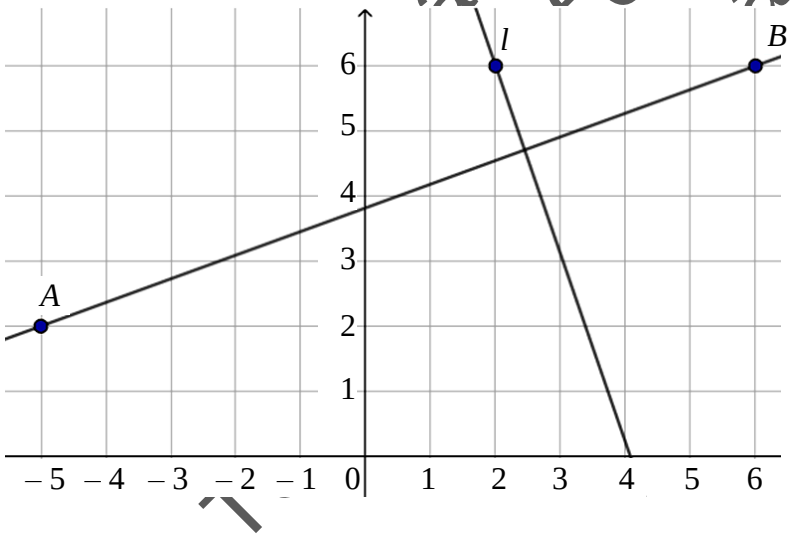
44. The equation of the line passing through the point of intersection of the lines $x=1$ and $y=0$ and parallel to line $x=\frac{y}{3}+1$ is

A. $y=3x-3$
B. $y=3x+3$
C. $y=\frac{1}{3}x+1$
D. $y=\frac{1}{3}x-1$

45. The equation of the line parallel to the line $x-y=1$ and perpendicular to the line $x+y=1$, will be

A. $x+y-1=0$
B. $x-y-1=0$
C. $x-y+1=0$
D. $x+y+1=0$

46. In the given diagram, the line l is perpendicular to the line AB, the slope of the line l is

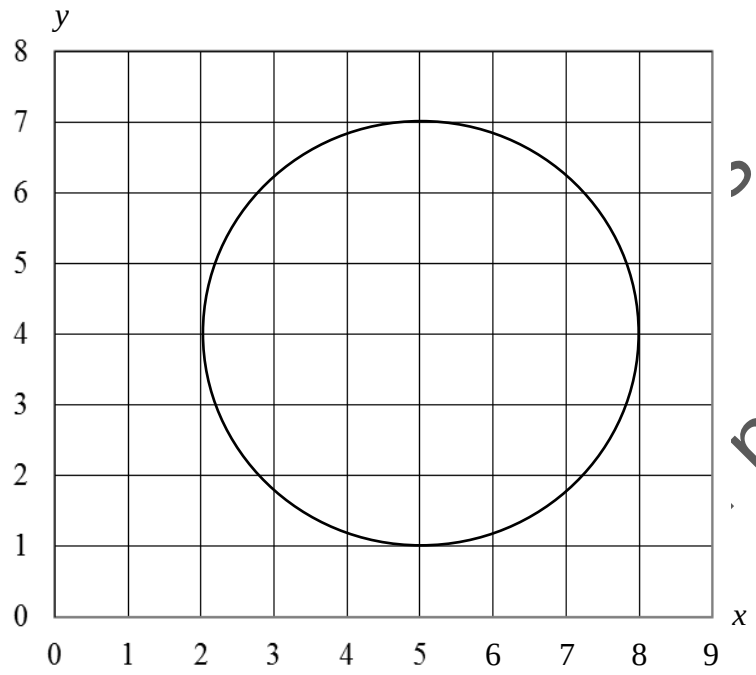


A. $\frac{4}{11}$.
B. $\frac{11}{4}$.
C. $-\frac{4}{11}$.
D. $-\frac{11}{4}$.

47. The centre of the circle $x^2 + y^2 + 8x + 18y + 5 = 0$ is

A. $(4, 9)$.
B. $(8, 18)$.
C. $(-4, -9)$.
D. $(-8, -18)$.

48. The given figure shows a circle whose equation is $(x-h)^2 + (y-k)^2 = r^2$.



The centre and radius of the circle is

	Centre of Circle	Radius of Circle
A	(3, 3)	3 units
B	(3, 3)	6 units
C	(4, 5)	6 units
D	(5, 4)	3 units

49. The number of tangent(s) that can be drawn from a point $(2, 7)$ to the circle $x^2 + y^2 = 50$ is/ are

A. one.
B. two.
C. three.
D. zero.

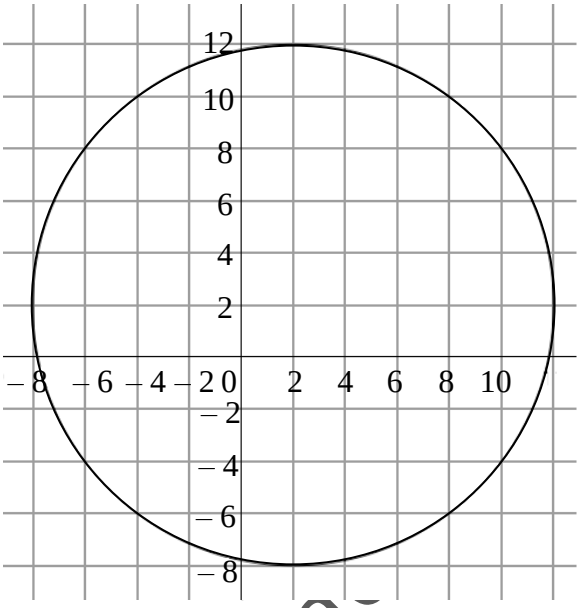
50. The radius of the circle represented by equation $x^2 + y^2 + 2gx + 2fy + c = 0$ is 4. If the centre of the circle is (2, 2), then the value of the c will be

A. -8
B. -4
C. 4
D. 8

51. The radius of the circle given by the equation $2x^2 + 2y^2 + 2x - 2y - 50 = 0$ is

A. 5
B. $\sqrt{50}$
C. $\sqrt{27}$
D. $\frac{\sqrt{102}}{2}$

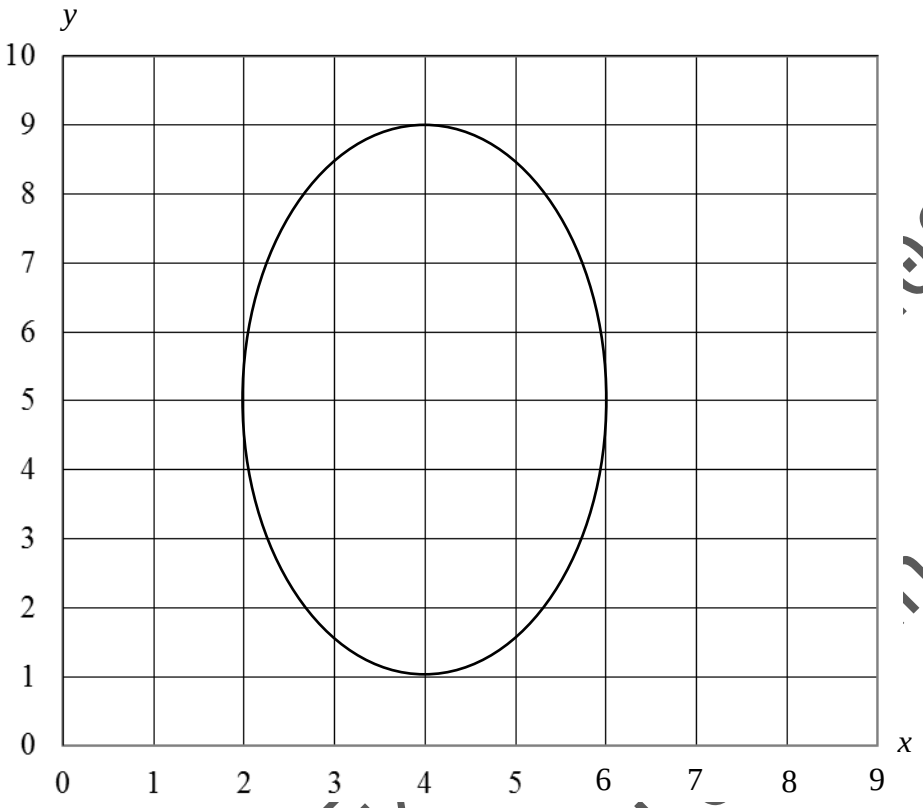
52. In the given diagram, the distance of the centre of the circle to any point on its circumference is



A. 5 units.
B. 10 units.
C. 15 units.
D. 20 units.

Use the given graph to answer Q.53 and Q.54.

The ellipse shown in the graph can be represented by the equation $\frac{(x-h)^2}{b^2}+\frac{(y-k)^2}{a^2}=1$.



53. The values of h and k are

	Value of h	Value of k
A	1	2
B	2	1
C	4	5
D	5	4

54. For the given ellipse, if the value of c is $2\sqrt{3}$, then the eccentricity is

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

B. $\sqrt{3}$.

C. $\frac{2}{\sqrt{3}}$.

D. $\frac{\sqrt{3}}{2}$.

55. If a circle has its centre at (0, 0) and the line $x = 3$ is tangent to it at the point (3, 0), then its equation is

A. $x^2 + y^2 = 3$

B. $x^2 + y^2 = 9$

C. $(x-3)^2 + y^2 = 9$

D. $(x-3)^2 + y^2 = 3$

56. For the ellipse $\frac{x^2}{81} + \frac{y^2}{9} = 1$, the length of the minor axis is

A. 6 units.

B. 9 units.

C. 18 units.

D. 81 units.

57. The equation of the hyperbola, having vertices at $(\pm 4, 0)$ and the length of its conjugate axis is 10 units, will be

A. $\frac{x^2}{25} - \frac{y^2}{16} = 1$

B. $\frac{x^2}{16} - \frac{y^2}{25} = 1$

C. $\frac{x^2}{100} - \frac{y^2}{16} = 1$

D. $\frac{x^2}{16} - \frac{y^2}{100} = 1$

58. The condition of tangency of the line $y = mx + c$ to the parabola $y^2 = 4ax$ is

A. $c = \frac{a}{m}$.

B. $c = \frac{m}{a}$.

C. $c = -\frac{a}{m}$.

D. $c = -\frac{m}{a}$.

59. If the focus of a parabola that opens downward is $(0,-2)$ and its vertex at $(0,0)$, then the equation of its directrix will be

A. $x=-2$
B. $y=-2$
C. $x=2$
D. $y=2$

60. A parabola given by the equation $(y+1)^2=-4(x+3)$ opens

A. upward.
B. leftward.
C. downward.
D. rightward.

61. Which of the following equations represents an ellipse?

A. $x^2-y^2+2x-40=0$
B. $3x^2-3y^2-2x-49=0$
C. $3x^2+2y^2-2x-106=0$
D. $3x^2-2y^2-2x-6=0$

62. The centre of an ellipse is (0, 0) and the major axis is along *y*-axis. If the length of its major axis is 6 units and the minor axis is 4 units, then it equation will be

A. $\frac{x^2}{36}+\frac{y^2}{16}=1$
B. $\frac{x^2}{16}+\frac{y^2}{36}=1$
C. $\frac{x^2}{9}+\frac{y^2}{4}=1$
D. $\frac{x^2}{4}+\frac{y^2}{9}=1$

63. The distance between the foci of a hyperbola is $2\sqrt{41}$ and the length of the transverse axis is 10. If the transverse axis is along *x*-axis and the centre at (0, 0), then the equation of the hyperbola will be

A. $\frac{x^2}{9}-\frac{y^2}{25}=1$
B. $\frac{x^2}{25}-\frac{y^2}{9}=1$
C. $\frac{x^2}{25}-\frac{y^2}{16}=1$
D. $\frac{x^2}{16}-\frac{y^2}{25}=1$

64. One of the vertices of the hyperbola $\frac{(y-4)^2}{16}-\frac{(x-1)^2}{9}=1$ is

A. (1, 8).
B. (8, 1).
C. (1, 4).
D. (5, 4).

65. The length of the latus rectum of the hyperbola $\frac{(y-3)^2}{16}-\frac{(x-3)^2}{9}=1$ is

A. $\frac{16}{9}$.
B. $\frac{9}{16}$.
C. $\frac{2}{9}$.
D. $\frac{9}{2}$.

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