

MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

TANGENTS AND NORMALS

Others

1. Show that the curves

$$\frac{x^2}{a^2 + \lambda_1} + \frac{y^2}{b^2 + \lambda_1} = 1 \quad \text{and}$$

$\frac{x^2}{a^2 + \lambda_2} + \frac{y^2}{b^2 + \lambda_2} = 1$ intersect at right angles.



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2. Find the condition for the following set of curves to intersect orthogonally:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ and } \frac{x^2}{A^2} - \frac{y^2}{B^2} = 1.$$



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3. Show that the following set of curves

intersect orthogonally: (i)

$$y = x^3 \text{ and } 6y = 7 - x^2, \quad \text{(ii)}$$

$$x^3 - 3xy^2 = -2 \text{ and } 3x^2y - y^3 = 2. \quad \text{(iii)}$$

$$x^2 + 4y^2 = 8 \text{ and } x^2 - 2y^2 = 4$$



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4. Find the angle of intersection of the

following curves : $y^2 = x$ and $x^2 = y$



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5. Show that the curves $4x = y^2$ and $4xy = k$ cut at right angles, if $k^2 = 512$.



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6. Find the equation of the tangent to the curve $\sqrt{x} + \sqrt{y} = a$, at the point $\left(\frac{a^2}{4}, \frac{a^2}{4}\right)$.



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7. Find a point on the curve $y = x^3 - 3x$ where the tangent is parallel to the chord joining $(1, -2)$ and $(2, 2)$.



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8. Find the points on the curve $xy + 4 = 0$ at which the tangents are inclined at an angle of 45° with the x - axis .



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9. Find the equation of normal line to the curve $y = x^3 + 2x + 6$ which is parallel to the line $x + 14y + 4 = 0$.



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10. If the tangent to the curve $y = x^3 + ax + b$ at $(1,6)$ is parallel to the line $x - y + 5 = 0$, find a and b



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11. Find the equation of the tangent to the curve $x = \sin 3t$, $y = \cos 2t$ at $t = \frac{\pi}{4}$.



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12. Prove that $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ touches the straight line $\frac{x}{a} + \frac{y}{b} = 2$ for all $n \in \mathbb{N}$, at the point (a, b) .



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13. At what point on the circle $x^2 + y^2 - 2x - 4y + 1 = 0$, the tangent is parallel to x-axis.



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14. Find the point on the curve $y = x^2$ where the slope of the tangent is equal to the x – coordinate of the point.



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15. At what point will be tangents to the curve $y = 2x^3 - 15x^2 + 36x - 21$ be parallel to x -axis? Also, find the equations of the tangents to the curve at these points.



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16. If the straight line $x \cos \alpha + y \sin \alpha = p$ touches the curve $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, then prove that $a^2 \cos^2 \alpha - b^2 \sin^2 \alpha = p^2$.



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17. Find the point on the curve $y = 3x^2 + 4$ at which the tangent is perpendicular to the line whose slope is $-\frac{1}{6}$.



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18. Find the equation of the normal to $y = 2x^3 - x^2 + 3$ at $(1,4)$.



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19. Find the point on the curve $y = 3x^2 - 9x + 8$ at which the tangents are equally inclined with the axes.



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20. Find the equation of the tangent to the curve $x = \theta + \sin \theta, y = 1 + \cos \theta$ at $\theta = \frac{\pi}{4}$.



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21. Find the equation of the normal to the curve $x^2 + 2y^2 - 4x - 6y + 8 = 0$ at the point whose abscissa is 2.



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22. The equation of the tangent at $(2, 3)$ on the curve $y^2 = ax^3 + b$ is $y = 4x - 5$. Find the values of a and b .



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23. Find the equation of the tangent line to the curve $y = x^2 + 4x - 16$ which is parallel to the line $3x - y + 1 = 0$.



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24. If the straight line $x \cos \alpha + y \sin \alpha = p$ touches the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then prove that $a^2 \cos^2 \alpha + b^2 \sin^2 \alpha = p^2$.



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25. Find the angle of intersection of the following curves: $xy = 6$ and $x^2y = 12$
 $y^2 = 4x$ and $x^2 = 4y$



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26. Show that the curves $x = y^2$ and $xy = k$ cut at right angles, if $8k^2 = 1$



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27. The curve $y = ax^3 + bx^2 + cx + 5$ touches the x-axis at $P(-2, 0)$ and cuts the y-axis at the point Q where its gradient is 3. Find the equation of the curve completely.



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28. Determine the quadratic curve $y = f(x)$ if it touches the line $y = x$ at the point $x = 1$ and passes through the point $(-1, 0)$.



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29. Find all the tangents to the curve $y = \cos(x + y)$, $-2\pi \leq x \leq 2\pi$ that are parallel to the line $x + 2y = 0$.



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30. Find the equation of the normal to the curve $y = (1 + x)^y + \sin^{-1}(\sin^2 x)$ at $x=0$.



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31. Find the equation of the tangent to the curve $y = (x^3 - 1)(x - 2)$ at the points where the curve cuts the x-axis.



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32. Show that the line $\frac{x}{a} + \frac{y}{b} = 1$ touches the curve $y = be^{-\frac{x}{a}}$ at the point where it crosses the y-axis.



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33. Find the equations of tangent and normal

to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at (x_1, y_1)



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34. Find the equation of the normal to the

curve $y = 2x^2 + 3 \sin x$ at $x = 0$.



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35. Find the coordinates of the points on the curve $y = x^2 + 3x + 4$, the tangents at which pass through the origin.



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36. Find the equations of the tangents drawn to the curve $y^2 - 2x^2 - 4y + 8 = 0$. from point $(1, 2)$



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37. Find the equation(s) of normal(s) to the curve $3x^2 - y^2 = 8$ which is (are) parallel to the line $x + 3y = 4$.



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38. Find the equation of the tangent line to the curve $y = \sqrt{5x - 3} - 2$ which is parallel to the line $4x - 2y + 3 = 0$



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39. Find the points on the curve $4x^2 + 9y^2 = 1$, where the tangents are perpendicular to the line $2y + x = 0$.



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40. Find the points on the curve $9y^2 = x^3$ where normal to the curve makes equal intercepts with the axes.



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41. Prove that the curves $xy = 4$ and $x^2 + y^2 = 8$ touch each other.



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42. Prove that the curves $y^2 = 4x$ and $x^2 + y^2 - 6x + 1 = 0$ touch each other at the points $(1, 2)$.



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43. Show that the angle between the tangent at any point P and the line joining P to the origin O is same at all points on the curve

$$\log(x^2 + y^2) = k \tan^{-1}\left(\frac{y}{x}\right)$$



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44. Find the slopes of the tangent and the normal to the curve $x^2 + 3y^2 = 5$ at $(1, 1)$



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45. Show that the tangents to the curve $y = x^3 - 3$ at the points where $x = 2$ and $x = -2$ are parallel.



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46. Prove that the tangents to the curve $y = x^2 - 5x + 6$ at the points $(2, 0)$ and $(3, 0)$ are at right angles.



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47. The slope of the curve

$2y^2 = ax^2 + b$ at $(1, -1)$ is -1 Find a, b



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48. Find the points on the curve

$y = x^3 - 2x^2 - x$ at which the tangent lines

are parallel to the line $y = 3x - 2$



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49. At what points on the curve $x^2 + y^2 - 2x - 4y + 1 = 0$, the tangents are parallel to the y-axis is?



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50. Find the required point be $P(x_1, y_1)$. The tangent to the curve $\sqrt{x} + \sqrt{y} = 4$ at which tangent is equally inclined to the axes.



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51. Show that the curves $2x = y^2$ and $2xy = k$ cut at right angles, if $k^2 = 8$.



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52. Show that the curves $xy = a^2$ and $x^2 + y^2 = 2a^2$ touch each other



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53. Find the slopes of the tangent and the normal to the curve $x^2 + 3y + y^2 = 5$ at $(1, 1)$



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54. Show that the tangents to the curve $y = 2x^3 - 3$ at the points where $x = 2$ and $x = -2$ are parallel.



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55. Prove that the tangents to the curve $y = x^2 - 5x + 6$ at the points $(2, 0)$ and $(3, 0)$ are at right angles.



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56. The slope of the curve $2y^2 = ax^2 + b$ at $(1, -1)$ is -1 . Find a, b .



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57. Find the slope of the normal to the curve

$$x = 1 - a \sin \theta, y = b \cos^2 \theta \text{ at } \theta = \frac{\pi}{2}.$$



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58. Find the slope of the normal to the curve

$$x = a \cos^3 \theta, y = a \sin^3 \theta \text{ at } \theta = \frac{\pi}{4}.$$



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59. Find the points on the curve $y = x^3 - 2x^2 - x$ at which the tangent lines are parallel to the line $y = 3x - 2$.



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60. Find the point on the curve $y = 2x^2 - 6x - 4$ at which the tangent is parallel to the x-axis.



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61. At what points on the curve $x^2 + y^2 - 2x - 4y + 1 = 0$, the tangents are parallel to the y-axis?



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62. Find the points on the curve $y = x^3$ at which the slope of the tangent is equal to the y-coordinate of the point.



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63. Find points on the curve $\frac{x^2}{9} - \frac{y^2}{16} = 1$ at which the tangents are parallel to the x-axis and y-axis.



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64. Find a point on the curve $y = (x - 3)^2$, where the tangent is parallel to the line joining $(4, 1)$ and $(3, 0)$.



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65. Find the required point be $P(x_1, y_1)$. The tangent to the curve $\sqrt{x} + \sqrt{y} = 4$ at which tangent is equally inclined to the axes.



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66. Find the points on the curve $4x^2 + 9y^2 = 1$, where the tangents are perpendicular to the line $2y + x = 0$



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67. Find the point on the curve $y = x^3 - 11x + 5$ at which the tangent has the equation $y = x - 11$



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68. Find the points on the curve $9y^2 = x^3$ where normal to the curve makes equal intercepts with the axes.



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69. Find the slope of the tangent and the normal to the curve $y = \sqrt{x^3}$ at $x = 4$



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70. Find the slopes of the tangent and the normal to the curve $y = \sqrt{x}$ at $x = 9$



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71. Find the slope of the tangent and the normal to the curve $y = x^3 - x$ at $x = 2$



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72. Find the slope of the tangent and the normal to the curve $y = 2x^2 + 3 \sin x$ at $x = 0$



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73. Find the slopes of the tangent and the normal to the curve $x = a(\theta - \sin \theta)$,
 $y = a(1 + \cos \theta)$ at $\theta = -\pi/2$



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74. Find the slopes of the tangent and the normal to the curve

$$x = a \cos^3 \theta, \quad y = a \sin^3 \theta \text{ at } \theta = \pi/4$$



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75. Find the slopes of the tangent and the normal to the curve

$$x = a(\theta - \sin \theta), \quad y = a(1 - \cos \theta) \quad \text{at}$$

$$\theta = \pi/2$$



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76. Find the slopes of the tangent and the normal to the curve $y = (\sin 2x + \cot x + 2)^2$ at $x = \pi/2$



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77. Find the slopes of the tangent and the normal to the curve $x^2 + 3y + y^2 = 5$ at $(1, 1)$



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78. Find the slopes of the tangent and the normal to the curve $xy = 6$ at $(1, 6)$



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79. Find the values of a and b if the slope of the tangent to the curve $xy + ax + by = 2$ at $(1, 1)$ is 2.



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80. If the tangent to the curve $y = x^3 + ax + b$ at $(1, -6)$ is parallel to the line $x - y + 5 = 0$, find a and b .



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81. Find a point on the curve $y = x^3 - 3x$ where the tangent is parallel to the chord joining $(1, -2)$ and $(2, 2)$.



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82. Find the points on the curve $x^3 - 2x^2 - 2x$ at which the tangent lines are parallel to the line $y = 2x - 3$.



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83. Find the points on the curve $y^2 = 2x^3$ at which the slope of the tangent is 3.



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84. Find the points on the curve $xy + 4 = 0$ at which the tangents are inclined at an angle of 45° with the x-axis.



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85. Find the point on the curve $y = x^2$ where the slope of the tangent is equal to the x-coordinate of the point.



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86. At what points on the circle $x^2 + y^2 - 2x - 4y + 1 = 0$, the tangent is parallel to the x-axis.



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87. At what point of the curve $y = x^2$ does the tangent make an angle of 45° with the x-axis?



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88. Find the points on the curve $y = 3x^2 - 9x + 8$ at which the tangents are equally inclined with the axes.



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89. At what points on the curve $y = 2x^2 - x + 1$ is the tangent parallel to the line $y = 3x + 4$?



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90. Find the point on the curve $y = 3x^2 + 4$ at which the tangent is perpendicular to the line whose slope is $-\frac{1}{6}$.



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91. Find the points on the curve $x^2 + y^2 = 13$, the tangent at each one of which is parallel to the line $2x + 3y = 7$.



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92. Find the points on the curve $2a^2y = x^3 - 3ax^2$ where the tangent is parallel to x-axis.



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93. At what points on the curve $y = x^2 - 4x + 5$ is the tangent perpendicular to the line $2y + x = 7$?



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94. Find the points on the curve $\frac{x^2}{4} + \frac{y^2}{25} = 1$ at which the tangents are parallel to the x-axis and y-axis.



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95. Find the points on the curve $x^2 + y^2 - 2x - 3 = 0$ at which the tangents are parallel to the x-axis and y-axis.



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96. Find the points on the curve $\frac{x^2}{9} + \frac{y^2}{16} = 1$ at which the tangents are parallel to the x-axis and y-axis.



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97. Show that the tangents to the curve $y = 7x^3 + 11$ at the points $x = 2$ and $x = -2$ are parallel.



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98. Find the points on the curve $y = x^3$ where the slope of the tangent is equal to x -coordinate of the point.



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99. Find the equation of the tangent to the curve $y = -5x^2 + 6x + 7$ at the point $(1/2, 35/4)$.



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100. Find the equation of the tangent and normal to the parabola $y^2 = 4ax$ at the point $(at^2, 2at)$.



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101. Find the equation of the normal to the curve $y = 2x^2 + 3 \sin x$ at $x = 0$.



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102. Find the equations of the tangent and the normal to $16x^2 + 9y^2 = 144$ at (x_1, y_1) where $x_1 = 2$ and $y_1 > 0$.



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103. Find the equations of tangent and normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at (x_1, y_1)



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104. Find the equation of the tangent line to the curve $x = 1 - \cos \theta$, $y = \theta - \sin \theta$ at $\theta = \pi/4$.



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105. Find the equations of the tangent and the normal at the point ' t ' on the curve $x = a \sin^3 t$, $y = b \cos^3 t$.



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106. Show that the line $\frac{x}{a} + \frac{y}{b} = 1$ touches the curve $y = be^{-\frac{x}{a}}$ at the point where it crosses the y-axis.



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107. Find the equation of the tangent to the curve $y = \frac{x - 7}{(x - 2)(x - 3)}$ at the point where it cuts the x-axis.



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108. Find the equation of the tangent to the curve $y = (x^3 - 1)(x - 2)$ at the points where the curve cuts the x-axis.



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109. Find the equation of the tangent line to the curve $y = \sqrt{5x - 3} - 2$ which is parallel to the line $4x - 2y + 3 = 0$.



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110. Find the equation of tangent line to $y = 2x^2 + 7$ which is parallel to the line $4x - y + 3 = 0$.



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111. Find the equation(s) of normal(s) to the curve $3x^2 - y^2 = 8$ which is (are) parallel to the line $x + 3y = 4$.



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112. Find the equation of normal line to the curve $y = x^3 + 2x + 6$ which is parallel to the line $x + 14y + 4 = 0$.



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113. Find the equations of the tangents drawn to the curve $y^2 - 2x^3 - 4y + 8 = 0$.



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114. Find the equation of the normal to the curve $x^2 = 4y$ which passes through the point $(1, 2)$.



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115. Find the coordinates of the points on the curve $y = x^2 + 3x + 4$, the tangents at which pass through the origin.



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116. For the curve $y = 4x^3 - 2x^5$ find all points at which the tangent passes through the origin.



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117. Find the equation of all lines having slope -1 that are tangents to the curve

$$y = \frac{1}{x-1}, x \neq 1.$$



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118. Prove that all normals to the curve $x = a \cos t + at \sin t$, $y = a \sin t - at \cos t$ are at a distance a from the origin.



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119. Find the equation of the normal to the curve $y = (1 + y)^y + \sin^{-1}(\sin^2 x) atx = 0$.



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120. Find all the tangents to the curve $y = \cos(x + y)$, $-2\pi \leq x \leq 2\pi$ that are parallel to the line $x + 2y = 0$.



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121. The curve $y = ax^3 + bx^2 + cx + 5$ touches the x-axis at $P(-2, 0)$ and cuts the y-axis at the point Q where its gradient is 3. Find the equation of the curve completely.



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122. Determine the quadratic curve $y = f(x)$ if it touches the line $y = x$ at the point $x = 1$ and passes through the point $(-1, 0)$.



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123. Find the equation of the tangent to the curve $\sqrt{x} + \sqrt{y} = a$, at the point $\left(\frac{a^2}{4}, \frac{a^2}{4}\right)$.



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124. Find the equation of the normal to

$$y = 2x^3 - x^2 + 3 \text{ at } (1, 4).$$



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125. Find the equations of the tangent and the

normal to the curve

$$y = x^4 - 6x^3 + 13x^2 - 10x + 5 \text{ at } (0, 5) \text{ at}$$

the indicated points



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126. Find the equations of the tangent and the normal to the curve $y = x^4 - 6x^3 + 13x^2 - 10x + 5$ at $x = 1$ at the indicated points



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127. Find the equations of the tangent and the normal to the curve $y = x^2$ at $(0, 0)$ at the indicated points



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128. Find the equations of the tangent and the normal to the curve $y = 2x^2 - 3x - 1$ at $(1, -2)$ at the indicated points



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129. Find the equations of the tangent to the curve $y^2 = \frac{x^3}{4-x}$ at point $(2, -2)$ on it



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130. Find the equations of the tangent and the normal to the curve $y = x^2 + 4x + 1$ at $x = 3$ at the indicated points



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131. Find the equations of the tangent and the normal to the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at $(a \cos \theta, b \sin \theta)$ at the indicated points



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132. Find the equations of the tangent and the normal to the curve $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at $(a \sec \theta, b \tan \theta)$ at the indicated points.



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133. Find the equations of the tangent and the normal to the curve $y^2 = 4ax$ at $(a/m^2, 2a/m)$ at the indicated points



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134. Find the equations of the tangent and the normal to the curve $c^2(x^2 + y^2) = x^2 y^2$ at $\left(\frac{c}{\cos \theta}, \frac{c}{\sin \theta}\right)$ at the indicated points



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135. Find the equations of the normal to the curve $xy = c^2$ at $(ct, c/t)$ on it.



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136. Find the equation of the tangent to the

curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at (x_1, y_1) on it.



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137. Find the equation of the normal to the

curve $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at (x_0, y_0)



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138. Find the equations of the tangent and the normal to the curve $x^{2/3} + y^{2/3} = 2$ at $(1, 1)$ at indicated points.



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139. Find the equations of the tangent and the normal to the curve $x^2 = 4y$ at $(2, 1)$ at indicated points.



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140. Find the equations of the tangent and the normal to the curve $y^2 = 4x$ at $(1, 2)$ at indicated points.



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141. Find the equations of the tangent and the normal to the curve $4x^2 + 9y^2 = 36$ at $(3 \cos \theta, 2 \sin \theta)$ at indicated points.



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142. Find the equations of the tangent and the normal to the curve $y^2 = 4ax$ at (x_1, y_1) at indicated points.



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143. Find the equations of the tangent and the normal to the curve $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at $(\sqrt{2}a, b)$ at indicated points.



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144. Find the equation of the tangent to the curve $x = \theta + \sin \theta$, $y = 1 + \cos \theta$ at $\theta = \pi / 4$.



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145. Find the equations of the tangent and the normal to the curve $x = \theta + \sin \theta$, $y = 1 + \cos \theta$ at $\theta = \pi / 2$ at indicated points.



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146. Find the equation of tangent and normal

to the curve $x = \frac{2at^2}{(1+t^2)}$, $y = \frac{2at^3}{(1+t^2)}$ at

the point for which $t = \frac{1}{2}$.



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147. Find the equations of the tangent and the

normal to the curve $x = at^2$, $y = 2at$ at

$t = 1$.



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148. Find the equations of the tangent and the normal to the curve $x = a \sec t$, $y = b \tan t$ at t .



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149. Find the equations of the tangent and the normal to the curve $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$ at θ at indicated points.



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150. Find the equations of the tangent and the normal to the curve

$$x = 3 \cos \theta - \cos^3 \theta, \quad y = 3 \sin \theta - \sin^3 \theta$$



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151. Find the equation of the normal to the curve $x^2 + 2y^2 - 4x - 6y + 8 = 0$ at the point whose abscissa is 2.



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152. Find the equation of the normal to the curve $ay^2 = x^3$ at the point (am^2, am^3) .



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153. The equation of the tangent at $(2, 3)$ on the curve $y^2 = ax^3 + b$ is $y = 4x - 5$. Find the values of a and b .



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154. Find the equation of the tangent line to the curve $y = x^2 + 4x - 16$ which is parallel to the line $3x - y + 1 = 0$.



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155. Find the equation of normal line to the curve $y = x^3 + 2x + 6$ which is parallel to the line $x + 14y + 4 = 0$.



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156. Determine the equation(s) of tangent(s) line to the curve $y = 4x^3 - 3x + 5$ which are perpendicular to the line $9y + x + 3 = 0$



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157. Find the equation of a normal to the curve $y = x(\log_e x)$ which is parallel to the line $2x - 2y + 3 = 0$.



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158. Find the equation of the tangent line to the curve $y = x^2 - 2x + 7$ which is parallel to the line $2x - y + 9 = 0$



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159. Find the equation of the tangent line to the curve $y = x^2 - 2x + 7$ which is perpendicular to the line $5y - 15x = 13$.



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160. Find the equations of all lines having slope 2 and that are tangent to the curve

$$y = \frac{1}{x - 3}, \quad x \neq 3.$$



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161. Find the equations of all lines of slope zero and that are tangent to the curve

$$y = \frac{1}{x^2 - 2x + 3}.$$



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162. Find the equation of the tangent to the curve $y = \sqrt{3x - 2}$ which is parallel to the line $4x - 2y + 5 = 0$.



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163. Find the equation of the tangent to the curve $x^2 + 3y - 3 = 0$, which is parallel to the line $y = 4x - 5$.



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164. Find the value of $n \in \mathbb{N}$ such that the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ touches the straight line $\frac{x}{a} + \frac{y}{b} = 2$ at the point (a, b) .



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165. Find the equation of the tangent to the curve $x = \sin 3t, y = \cos 2t$ at $t = \frac{\pi}{4}$.



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166. At what point will be tangents to the curve $y = 2x^3 - 15x^2 + 36x - 21$ be parallel to x-axis? Also, find the equations of the tangents to the curve at these points.



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167. Find the equation of the tangents to the curve $3x^2 - y^2 = 8$, which passes through the point $\left(\frac{4}{3}, 0\right)$.



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168. Find the angle of intersection of $xy = 6$
and $x^2y = 12$



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169. Find the angle of intersection of $y^2 = 4x$
and $x^2 = 4y$



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170. Find the angle between the parabolas $y^2 = 4ax$ and $x^2 = 4by$ at their point of intersection other than the origin.



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171. Show that the curves $x = y^2$ and $xy = k$ cut at right angles, if $8k^2 = 1$.



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172. Find the value of p for which curves $x^2 = 9p(9 - y)$ and $x^2 = p(y + 1)$ cut each other at right angles.



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173. Show that the curves $xy = a^2$ and $x^2 + y^2 = 2a^2$ touch each other



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174. Show the condition that the curves $ax^2 + by^2 = 1$ and $a'x^2 + b'y^2 = 1$ should intersect orthogonally



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175. If the straight line $x \cos \alpha + y \sin \alpha = p$ touches the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then prove that $a^2 \cos^2 \alpha + b^2 \sin^2 \alpha = p^2$.



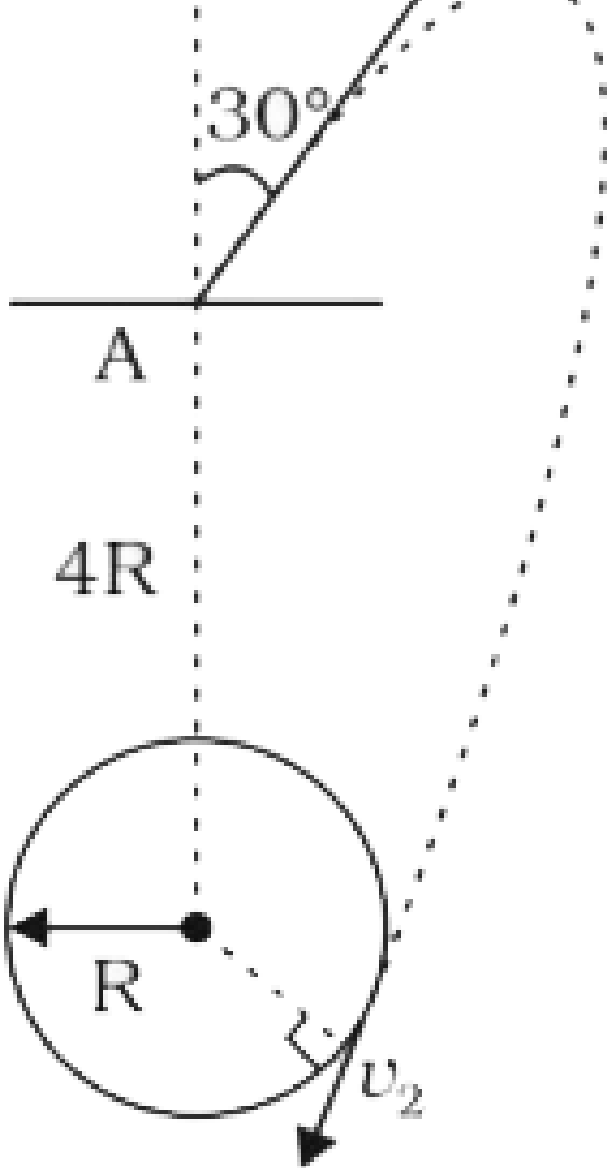
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176. A particle is projected from point A, that is at a distance $4R$ from the centre of the earth, with speed in a direction making 30° with the line joining the centre of the earth and point A, as shown.

If particle passes grazing the surface of the earth, then the speed v_1 in m/s is $10\sqrt{2}P$. Find value of P. Consider gravitational interaction only between these two. (use

$$\frac{GM}{R} = 6.4 \times 10^7 \text{ m}^2 / \text{s}^2$$





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177. Find the angle of intersection of the curves $y^2 = x$ and $x^2 = y$



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178. Find the angle of intersection of curve $y = x^2$ and $x^2 + y^2 = 20$



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179. Find the angle of intersection of curve

$$2y^2 = x^3 \text{ and } y^2 = 32x$$



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180. Find the angle of intersection of curve

$$x^2 + y^2 - 4x - 1 = 0 \quad \text{and}$$

$$x^2 + y^2 - 2y - 9 = 0$$



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181. Find the angle of intersection of curve

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ and } x^2 + y^2 = ab$$



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182. Find the angle of intersection of curve

$$x^2 + 4y^2 = 8 \text{ and } x^2 - 2y^2 = 2$$



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183. Find the angle of intersection of curve

$$x^2 = 27y \text{ and } y^2 = 8x$$



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184. Find the angle of intersection of curve

$$x^2 + y^2 = 2x \text{ and } y^2 = x$$



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185. Find the angle of intersection of curve

$$y = 4 - x^2 \text{ and } y = x^2$$



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186. Show that $y = x^3$ and $6y = 7 - x^2$

intersect orthogonally:



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187. Show that $x^3 - 3xy^2 = (-2)$ and $3x^2y - y^3 = 2$ intersect orthogonally.



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188. Show that $x^2 + 4y^2 = 8$ and $x^2 - 2y^2 = 4$ intersect orthogonally



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189. Show that $x^2 = 4y$ and $4y + x^2 = 8$ intersect orthogonally at $(2, 1)$



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190. Show that $x^2 = y$ and $x^3 + 6y = 7$ intersect orthogonally at $(1, 1)$



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191. Show that $y^2 = 8x$ and $2x^2 + y^2 = 10$ at $(1, 2\sqrt{2})$



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192. Show that the curves $4x = y^2$ and $4xy = k$ cut at right angles, if $k^2 = 512$.



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193. Show that the curves $2x = y^2$ and $2xy = k$ cut at right angles, if $k^2 = 8$.



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194. Prove that the curves $xy = 4$ and $x^2 + y^2 = 8$ touch each other.



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195. Prove that the curves $y^2 = 4x$ and $x^2 + y^2 - 6x + 1 = 0$ touch each other at the points $(1, 2)$.



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196. Find the condition for the following set of curves to intersect orthogonally:

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \quad \text{and} \quad xy = c^2 \quad \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

and $\frac{x^2}{A^2} - \frac{y^2}{B^2} = 1$.



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197. Find the condition for the two concentric ellipses

$$a_1x^2 + b_1y^2 = 1 \text{ and } a_2x^2 + b_2y^2 = 1 \quad \text{to}$$

intersect orthogonally.



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198. Show that the curves

$$\frac{x^2}{a^2 + \lambda_1} + \frac{y^2}{b^2 + \lambda_1} = 1 \quad \text{and}$$

$\frac{x^2}{a^2 + \lambda_2} + \frac{y^2}{b^2 + \lambda_2} = 1$ intersect at right angles.



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199. If the straight line $x \cos \alpha + y \sin \alpha = p$ touches the curve $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then prove that $a^2 \cos^2 \alpha + b^2 \sin^2 \alpha = p^2$.



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200. Find the point on the curve $y = x^2 - 2x + 3$, where the tangent is parallel to x-axis.



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201. Find the slope of the tangent to the curve $x = t^2 + 3t - 8, y = 2t^2 - 2t - 5$ at $t = 2$.



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202. If the tangent line at a point (x, y) on the curve $y = f(x)$ is parallel to x-axis, then write the value of $\frac{dy}{dx}$.



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203. Write the value of $\frac{dy}{dx}$, if the normal to the curve $y = f(x)$ at (x, y) is parallel to y-axis.



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204. If the tangent to a curve at a point (x, y) is equally inclined to the coordinate axes, then write the value of $\frac{dy}{dx}$.



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205. If the tangent line at a point (x, y) on the curve $y = f(x)$ is parallel to y-axis, find the value of $\frac{dx}{dy}$.



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206. Find the slope of the normal at the point

' t ' on the curve $x = \frac{1}{t}$, $y = t$.



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207. Write the coordinates of the point on the

curve $y^2 = x$ where the tangent line makes an

angle $\frac{\pi}{4}$ with x-axis.



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208. Write the angle made by the tangent to the curve $x = e^t \cos t$, $y = e^t \sin t$ at $t = \frac{\pi}{4}$ with the x-axis.



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209. Write the equation of the normal to the curve $y = x + \sin x \cos x$ at $x = \frac{\pi}{2}$.



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210. Find the coordinates of the point on the curve $y^2 = 3 - 4x$ where tangent is parallel to the line $2x + y - 2 = 0$.



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211. Write the equation of the tangent to the curve $y = x^2 - x + 2$ at the point where it crosses the y-axis.



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212. Write the angle between the curves $y^2 = 4x$ and $x^2 = 2y - 3$ at the point $(1, 2)$.



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213. Write the angle between the curves $y = e^{-x}$ and $y = e^x$ at their point of intersection.



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214. Write the slope of the normal to the curve

$$y = \frac{1}{x} \text{ at the point } \left(3, \frac{1}{3}\right)$$



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215. Write the coordinates of the point at

which the tangent to the curve

$y = 2x^2 - x + 1$ is parallel to the line

$$y = 3x + 9.$$



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216. Write the equation of the normal to the curve $y = \cos x$ at $(0, 1)$.



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217. The equation to the normal to the curve $y = \sin x$ at $(0, 0)$ is

(a) $x = 0$

(b) $y = 0$

(c) $x + y = 0$

(d) $x - y = 0$



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218. Find the equation of the tangent to the curve $y = x - \sin x \cos x$ at $x = \frac{\pi}{2}$



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219. The equation of the normal to the curve $y = x(2 - x)$ at the point $(2, 0)$ is

(a) $x - 2y = 2$

(b) $x - 2y + 2 = 0$

(c) $2x + y = 4$

(d) $2x + y - 4 = 0$



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220. The point on the curve $y^2 = x$ where tangent makes 45° angle with x-axis is

(a) $(1/2, 1/4)$

(b) $(1/4, 1/2)$

(c) $(4, 2)$

(d) $(1, 1)$



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221. If the tangent to the curve $x = at^2$, $y = 2at$ is perpendicular to x-axis, then its point of contact is

(a) (a, a)

(b) $(0, a)$

(c) $(0, 0)$

(d) $(a, 0)$



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222. The point on the curve $y = x^2 - 3x + 2$

where tangent is perpendicular to $y = x$ is

(a) $(0, 2)$

(b) $(1, 0)$

(c) $(-1, 6)$

(d) $(2, -2)$



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223. The point on the curve $y = 12x - x^2$

where the slope of the tangent is zero will be

(0, 0) (b) (2, 16) (c) (3, 9) (d) (6, 36)



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224. The angle between the curves $y^2 = x$ and $x^2 = y$ at $(1, 1)$ is $\frac{\tan^{-1} 4}{3}$ (b) $\frac{\tan^{-1} 3}{4}$ (c) 90 (d) 45



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225. The equation of the normal to the curve $3x^2 - y^2 = 8$ which is parallel to the line $x +$

$$3y = 8 \text{ is}$$



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226. The equation of tangent at those points where the curve $y = x^2 - 3x + 2$ meets x-axis are:

A. (a) $x - y + 2 = 0 = x - y - 1$

B. (b) $x + y - 1 = 0 = x - y - 2$

C. (c) $x - y - 1 = 0 = x - y$

D. (d) $x - y = 0 = x + y$

Answer: null



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227. The slope of the tangent to the curve

$x = t^2 + 3t - 8$, $y = 2t^2 - 2t - 5$ at point

$(2, -1)$ is

(a) $22/7$

(b) $6/7$

(c) -6

(d) $7/6$



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228. At what points the slope of the tangent to the curve $x^2 + y^2 - 2x - 3 = 0$ is zero

- (a) $(3, 0)$, $(-1, 0)$ (b) $(3, 0)$, $(1, 2)$ (c) $(-1, 0)$, $(1, 2)$ (d) $(1, 2)$, $(1, -2)$



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229. The angle of intersection of the curves

$$xy = a^2 \text{ and } x^2 - y^2 = 2a^2 \text{ is}$$

- (a) 0°

(b) 45°

(c) 90°

(d) 30°



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230. If the curve $ay + x^2 = 7$ and $x^3 = y$ cut orthogonally at $(1, 1)$, then a

is equal to

(a) 1 (b) -6 (c) 6 (d) 0



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231. If the line $y = x$ touches the curve $y = x^2 + bx + c$ at a point $(1, 1)$ then

(a) $b = 1, c = 2$

(b) $b = -1, c = 1$

(c) $b = 2, c = 1$

(d) $b = -2, c = 1$



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232. The slope of the tangent to the curve

$x = 3t^2 + 1, y = t^3 - 1$ at $x = 1$ is

(a) $1/2$ (b) 0 (c) -2 (d) ∞



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233. The curves $y = ae^x$ and $y = be^{-x}$ cut orthogonally, if

(a) $a = b$ (b) $a = -b$ (c) $ab = 1$ (d) $ab = 2$



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234. The equation of the normal to the curve $x = a \cos^3 \theta$, $y = a \sin^3 \theta$ at the point $\theta = \pi/4$ is

(a) $x = 0$

(b) $y = 0$

(c) $x = y$

(d) $x + y = a$



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235. If the curves $y = 2e^x$ and $y = ae^{-x}$ intersect orthogonally, then $a =$ (a) $1/2$ (b) $-1/2$ (c) 2 (d) $2e^2$



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236. The point on the curve $y = 6x - x^2$ at which the tangent to the curve is inclined at $\pi/4$ to the line $x + y = 0$ is

(a) $(-3, -27)$

(b) $(3, 9)$

(c) $7/2, 35/4$

(d) $(0, 0)$



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237. The angle of intersection of the parabola

$y^2 = 4ax$ and $x^2 = 4ay$ at the origin is

(a) $\pi / 6$

(b) $\pi / 3$

(c) $\pi / 2$

(d) $\pi / 4$



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238. The angle of intersection of the curves

$y = 2 \sin^2 x$ and $y = \cos 2x$ at $x = \frac{\pi}{6}$ is

(a) $\pi / 4$

(b) $\pi / 2$

(c) $\pi / 3$

(d) $\pi / 6$



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239. Any tangent to the curve

$$y = 2x^7 + 3x + 5$$

(a) is parallel to x-axis

(b) is parallel to y-axis

(c) makes an acute angle with x-axis

(d) makes an obtuse angle with x-axis.



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240. The point on the curve $9y^2 = x^3$, where the normal to the curve makes equal intercepts with the axes is (a) $(4, \pm 8/3)$ (b) $(-4, 8/3)$ (c) $(-4, -8/3)$ (d) $(8/3, 4)$



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241. The slope of the tangent to the curve $x = t^2 + 3t - 8$, $y = 2t^2 - 2t - 5$ at the point $(2, -1)$ is

(a) $22/7$

(b) $6/7$

(c) $7/6$

(d) $-6/7$



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242. The line $y = mx + 1$ is a tangent to the curve $y^2 = 4x$, if the value of m is

(a) 1

(b) 2

(c) 3

(d) $1/2$



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243. The normal at the point $(1,1)$ on the curve

$$2y + x^2 = 3 \text{ is}$$

(A) $x + y = 0$

(B) $xy = 0$

(C) $x + y + 1 = 0$

(D) $xy = 0$



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244. The normal to the curve $x^2 = 4y$ passing

(1,2) is

(A) $x + y = 3$

(B) $xy = 3$

(C) $x + y = 1$

(D) $xy = 1$



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