MATHS

BOOKS - RD SHARMA MATHS (HINGLISH)

DIFFERENTIALS, ERRORS AND APPROXIMATIONS

Solved Examples And Exercises

1. Find the approximate value of $(\log)_{10}1005$, given that $(\log)_{10}e = 0.4343$

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2. The height of a cone increases by $k\%$ its semi-vertical angle remaining the same. What is the approximate percentage increase (i) in total surface area, and (ii) in the volume, assuming that k is small?

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3. The pressure p and the volume v of a gas are connected by the relation $pv^{1.4} = const.$ Find the percentage error in p corresponding to a decrease of $\%$ in $v.$

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4. Find the percentage error in calculating the surface area of a cubical box if an error of 1% is made in measuring the lengths of edges of the cube.

A. 1%

B. 2%

C. 3%

D. None of these

Answer: B

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5. A circular metal plate expends under heating so that its radius increases by $k\%$. Find the approximate increase in the area of

the plate, if the radius of the plate before heating is 10 cm.

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6. The radius of a sphere shrinks from 10 to 9.8 cm. Find approximately the decrease in its volume.

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7. If $y = \sin x and dx$ change from $\frac{\pi}{2} \to \frac{22}{14}$, what is the approximate change in y?

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8. find the approximate volume of metal in a hollow spherical shell whose internal and external radii are 3cm and 3.0005cm, respectively.

A. $v = 0.018\pi cm^3$

B. $v = 0.18\pi cm^3$

C. $v = 0.0018\pi cm^3$

D. None of these

Answer: A

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9. Use differentials to approximate the cube root of 127.

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10. Use differentials to find the approximate value of $(\log)_e(4.01)$, having given that $(\log)_e 4 = 1.3863$.

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11. If the ratio of base radius and height of a cone is 1:2 and percentage error in radius is $\lambda\%$, then the error in its volume is $\lambda\%$ (2) 2 $\lambda\%$ (c) 3 $\lambda\%$ (d) none of these

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12. The pressure P and volume V of a gas are connected by the relation $PV^{\frac{1}{4}} =$ constant. The percentage increase in the pressure corresponding to a deminition of % in the volume is $\frac{1}{2}\%$ (b) $\frac{1}{4}\%$ (c) $\frac{1}{8}\%$ (d) none of these

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13. If $y = x^n$, then the ratio of relative errors in y and x is (a) $1:1$ (b) 2:1 (c) 1:n (d) n:1

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14. Find the approximate change in the volume V of a cube of side x meters caused by increasing by side by 2%.

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15. A circular metal plate expands under heating so that its radius increases by 2%. Find the approximate increase in the area of

the plate if the radius of the plate before heating is 10cm.

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16. The time t of a complete oscillation of a simple pendulum of length l is given by the equation $T = 2\pi\sqrt{\frac{1}{g}}$ where g is constant. What is the percentage error in T when l is increased by 1%?

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17. If $y = x^4 - 10$ and if x changes from 2 to 1.99, what is the approximate change in y? Also, find the changed value of y.

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18. If in a triangle ABC, the side c and the angle C remain constant, while the remaining elements are changed slightly, using differentials show that $\frac{da}{csA} + \frac{db}{\cos B} = 0$

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19. Using differentials find the approximate value of $\tan 46^0$, if it is being given that $1^0 = 0.01745$ radians.

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20. If there is an error of 2% in measuring the length of simple pendulum, then percentage error in its period is: (a) 1% (b)2% (c) 3% (d) 4%

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21. If a triangle ABCis not a right angled traingle abd inscribed in a fixed circle.If A,B,C be slightly varied then, $\frac{da}{cas A} + \frac{db}{\cos B} = 0.$

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22. If an error of $k\%$ is made in measuring the radius of a sphere, then percentage error in its volume.

k%

(b) 3k%

(c) 3k%

(d) $\frac{k}{3}\%$

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23. If there is an error of a% in measuring the edge of a cube, then percentage error in its surface is 2a% (b) $\frac{a}{2}\%$ (c) $3a\%$ (d) none of these

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24. While measuring the side of an equilateral triangle an error of k% is made, the percentage error in its area

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25. The height of a cylinder is equal to the radius. If an error of $\alpha\%$ is made in the height, then percentage error in its volume is $\alpha\%$ (b) $2\alpha\%$ (c) $3\alpha\%$ (d) none of these

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26. A sphere of radius $100mm$ shrinks to radius 98mm, then the approximate decrease in its volume is (a)$12000\pi mm^3$ (b) $80000\pi mm^3$ (C) $8000\pi mm^3$ (d) $120\pi mm^3$

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27. If $(\log)_e 4 - 1.3868, then (\log)_e 4.01 =$ 1.3968 (b) 1.3898 (c) 1.3893 (d) none of these

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28. Find the percentage error in calculating the volume of a cubical box if an error if 1% is made in measuring the length of edges of the cube.

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29. The approximate value of $(33)^{\frac{1}{5}}$ is

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30. Use differentials to approximate $\sqrt{25.2}$

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31. The circumference of a circle is measured as 28cm with an error of 0.01cm. The percentage error in the area is

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32. If $y = x^4 - 10$ and if x changes from 2 to 1.99, what is the approximate change in y ? Also, find the changed value of y.

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33. A circular metal plate expands under heating so that its radius increases by 2%. Find the approximate increase in the area of the plate if the radius of the plate before heating is 10 cm.

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34. Find the percentage error in calculating the volume of a cubical box if an error of 1% is made in measuring the length of edges of the cube.

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35. The time t of a complete oscillation of a simple pendulum of length l is given by the equation $T = 2\pi\sqrt{\frac{1}{g}}$ where g is constant.

What is the percentage error in T when l is increased by 1%?

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36. Find the approximate change in the volume V of a cube of side x meters caused by increasing the side by 2%.

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37. If the radius of a sphere is measured as 9 cm with an error of 0.03 cm, then find the approximating error in calculating its volume.

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38. Find the approximate value of $f(3.02)$, where $f(x) = 3x^2 + 5x + 3$.

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39. Find the approximate volume of metal in a hollow spherical shell whose internal and external radii are 3 cm and 3.0005 cm, respectively.

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40. Use differentials to approximate $\sqrt{25.2}$.

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41. Use differentials to approximate the cube root of 127.

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42. Use differentials to find the approximate value of $\sqrt{0.037}$.

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43. Use differentials to find the approximate value of $(\log)_e(4.01)$, having given that $(\log)_e 4 = 1.3863$.

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44. Using differentials find the approximate value of $\tan 46^0$, if it is being given that $1^0 = 0.01745$ radians.

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45. If in a triangle ABC , the side c and the angle C remain constant, while the remaining elements are changed slightly, using differentials show that $\frac{da}{\cos A}+\frac{db}{\cos B}=0$

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46. If a triangle ABC, inscribed in a fixed circle, be slightly varied in such away as to have its vertices always on the circle, then show that $\frac{da}{cas A}+\frac{db}{\cos B}+\frac{dc}{\cos C}=0.$

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47. If $y = \sin x$ and x changes from $\pi/2$ to $22/14$, what is the approximate change in y?

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48. The radius of a sphere shrinks from 10 to 9.8 cm. Find approximately the decrease in its volume.

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49. A circular metal plate expands under heating so that its radius increases by k%. Find the approximate increase in the area of the plate, if the radius of the plate before heating is 10 cm.

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50. Find the percentage error in calculating the surface area of a cubical box if an error of 1% is made in measuring the lengths of edges of the cube.

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51. If there is an error of 0.1% in the measurement of the radius of a sphere, find approximately the percentage error in the calculation of the volume of the sphere.

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52. The pressure p and the volume v of a gas are connected by the relation $pv^{1\cdot 4} = const.$

Find the percentage error in p corresponding to a decrease of 1/2% in v.

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53. The height of a cone increases by $k\%$ its semi-vertical angle remaining the same. What is the approximate percentage increase (i) in total surface area, and (ii) in the volume, assuming that k is small?

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54. Using differentials, find the approximate value of $\sqrt{25.02}$

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55. Using differentials, find the approximate value of $(0.009)^{1/3}$

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56. Using differentials, find the approximate value of $(0.007)^{1/3}$

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57. Using differentials, find the approximate value of $\sqrt{401}$

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58. Using differentials, find the approximate value of $(15)^{1/4}$

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59. Using differentials, find the approximate value of $(255)^{1/4}$

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60. Using differentials, find the approximate value of $\frac{1}{(2.002)^2}$

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61. Using differentials, find the approximate value of $(\log)_e 4.04$, it being given that $(\log)_{10} 4 = 0.6021$ and $(\log)_{10} e = 0.4343$.

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62. Using differentials, find the approximate value of $(\log)_e 10.02$, it being given that $(\log)_e 10 = 2.3026$.

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63. Using differentials, find the approximate value of $(\log)_{10} 10.1$, it being given that $(\log)_{10} e = 0.4343$.

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64. Find approximate value of $\frac{1}{\sqrt{25.1}}$ using differentials.

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65. Using differentials, find approximate value of $\sin\left(\frac{22}{14}\right)$

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66. Approximate $(80)^{1/4}$ using differentials

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67. Use differentials and find approximate value of $(29)^{1/3}$

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68. Using differentials, find the approximate value of $(66)^{1/3}$

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69. Using differentials, find the approximate value of $\sqrt{26}$

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70. Using differentials, find the approximate value of $\sqrt{37}$

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71. Using differentials, find the approximate value of $\sqrt{0.48}$

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72. Using differentials, find the approximate value of $(82)^{\frac{1}{4}}$ upto 3 places of decimal .

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73. Use differentials to find the approximate value of $(17)^{\frac{1}{4}}$

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74. Using differentials, find the approximate value of $(33)^{1/5}$

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75. Using differentials, find the approximate value of $\sqrt{36.6}$

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76. Using differentials, find the approximate value of $25^{1/3}$

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77. Using differentials, find the approximate value of $\sqrt{49.5}$

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78. Using differentials, find the approximate value of $(3.968)^{3/2}$

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79. Using differentials, find the approximate value of $(1.999)^{5}$

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80. Using differentials, find the approximate value of $\sqrt{0.082}$

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81. Find the approximate value of $f(2.01)$, where $f(x) = 4x^2 + 5x + 2$.

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82. Find the approximate value of $f(5.001)$, where $f(x) = x^3 - 7x^2 + 15$.

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83. Find the approximate value of $(\log)_{10}1005$, given that $(\log)_{10}e = 0.4343$

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84. If the radius of a sphere is measured as 9 cm with an error or 0.03 m, find the approximate error in calculating its surface area.

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85. Find the approximate change in the surface area of a cube of side x metres caused by decreasing the side by 1%.

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86. If the radius of a sphere is measured as 7 m with an error or 0.02 m, find the approximate error in calculating its volume.

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87. Find the approximate change in the volume of a cube of side x metres caused by increasing the side by 1%.

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88. If the relative error in measuring the radius of a circular plane is α , find the relative error in measuring its area.

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89. If the percentage error in the radius of a sphere is α , find the percentage error in its volume.

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90. A piece of ice is in the form of a cube melts so that the percentage error in the edge of cube is a , then find the percentage error in its volume.

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91. If there is an error of 2% in measuring the length of simple pendulum, then percentage error in its period is: 1% (b) 2% (c) 3% (d) 4%

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92. If there is an error of a% in measuring the edge of a cube, then percentage error in its surface is (a) 2a% (b) $\frac{a}{2}\ \%$ (c) 3a% (d) none of these

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93. If an error of k% is made in measuring the radius of a sphere, then percentage error in its volume is (a) k% (b) 3k% (c) 2k% (d) $k/3\ \%$

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94. The height of a cylinder is equal to the radius. If an error of $\alpha\%$ is made in the height, then percentage error in its volume is $\alpha\%$ (b) $2\alpha\%$ (c) $3\alpha\%$ (d) none of these

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95. While measuring the side of an equilateral triangle an error of $k\%$ is made, the percentage error in its area is $k\%$ (b) $2k\%$ (c) $\frac{k}{2}\%$ (d) $3k\%$

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96. If $(\log)_e 4 = 1.3868$, then $(\log)_e 4.01 =$

(a) 1.3968 (b) 1.3898 (c) 1.3893 (d) none of these

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97. A sphere of radius 100 mm shrinks to radius 98 mm, then the approximate decrease in its volume is $12000\,\pi\,mm^3$ (b) $800\,\pi\,mm^3$ (c) $80000\,\pi\,mm^3$ (d) $120\,\pi\,mm^3$

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98. If the ratio of base radius and height of a cone is 1:2 and percentage error in radius is $\lambda\%$, then the error in its volume is $\lambda\%$ (b) $2\lambda\%$ (c) $3\lambda\%$ (d) none of these

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99. The pressure P and volume V of a gas are connected by the relation $PV^{\frac{1}{4}} =$ constant. The percentage increase in the pressure

corresponding to a deminition of % in the volume is $\frac{1}{2}\%$ (b) $\frac{1}{4}\%$ (c) $\frac{1}{8}\%$ (d) none of these

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100. If $y = x^n$, then the ratio of relative errors in $yandx$ is $1:1$ (b) 2:1 (c) 1:n (d) n:1

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101. The approximate value of $(33)^{1/5}$ is (a) 2.0125 (b) 2.1 (c) 2.01 (d) none of these

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102. The circumference of a circle is measured as 28cm with an error of 0.01cm. The percentage error in the area is $\frac{1}{14}$ (b) 0.01 (c) $\frac{1}{7}$ (d) none of these

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Others

1. Show that the relative error in computing the volume of a sphere, due to an error in measuring the radius, is approximately equal to three times the relative error in the radius.

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2. Find the approximate value of $\cos 61o$ using differentials, it being given that $\sin 60o = 0.86603$ and $1o = 0.01745$ radian

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3. Approximate $\cos\left(\frac{11\pi}{36}\right)$ using differentials.

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4. For the function $y = x^2$, if $x = 10$ and $x = 0.1$. Find $\triangle y$.

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5. If $y = (\log)_e x$, then find y when $x = 3$ and $x = 0.03$.

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