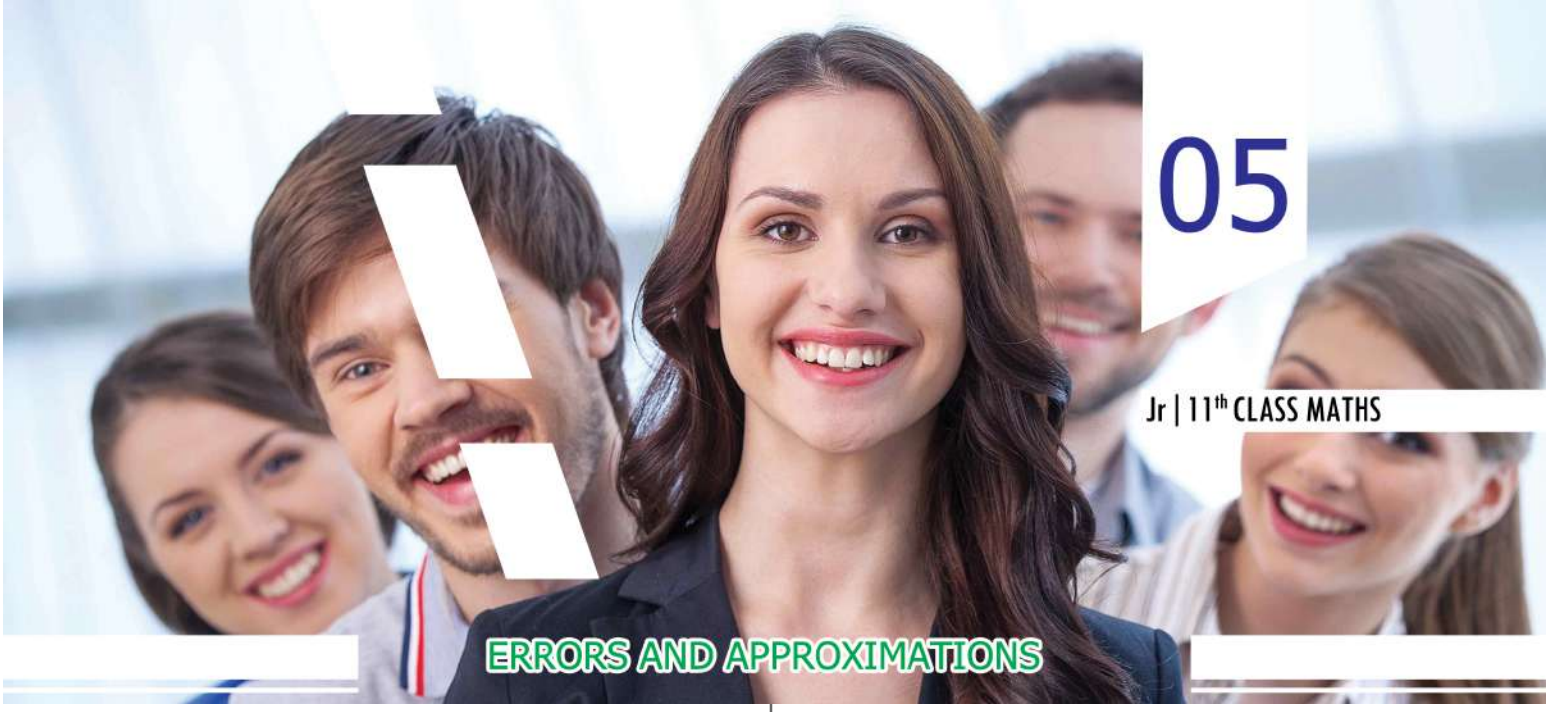
CHANAKYA ACADEMY OF PROFESSIONAL STUDIES

NEET | JEE | CA

JEE MAIN

MATHEMATICS



Infinitesimals:

- If x is a quantity δx (change in x) is a small quantity when compared to x and $x\delta x, x\delta x^2, x\delta x^3, \ldots\ldots$ are small quantities (when compared to x and δx) in the decreasing order of magnitude, then these quantities are called infinitesimals of order 1, order 2 and order 3 .....
- If $y = f(x)$, δx is any change in x then the corresponding change in y is δy. It is given by $\delta y = f(x+\delta x) - f(x)$
- $\left(\frac{dy}{dx}\right)\delta x$ is called differential of y It is denoted by dy or df.

  $\therefore dy = f^1(x)\delta x$
- The approximate value of the function is $f(x+\delta x) \cong f(x) + f^1(x)\delta x$
- $\delta y \cong dy$

EX.1: The approximate value of $\log(9.01)$ **when** $\log 3 = 1.0986$

Sol: $\because \log 3 = (1.0986) \Rightarrow \log 9 = \log 3^2$

$= 2\log 3 = 2(1.0986) = 2.1972$

let $x = 9 \& \delta x = 0.01$

and $y = f(x) = \log x$

Then, $\log(9.01) = f(x) + f'(x).\delta x$

$= \log 9 + \frac{1}{9}(0.01) = 2.1972 + 0.0011 = 2.1983$

EX.2: Find the approximate value of $(x-2)^3(x-3)$ **when** $x = 3.05$

Sol: $\delta f \approx df = \frac{df}{dx}.\delta$ **x**

$= \left[3(x-2)^2(x-3) + (x-2)^3\right].\delta x$

$= 1(0.05) = 0.05$

$f(x) = (3-2)^2(3-3) = 0$

$\therefore$ approximate value = 0 + 0.05 = 0.05

Error ,Relative Error , Percentage Error:

- Let y=f(x) be a function defined on an interval A and $x \in A$. Let δx be any change in x and δy be the corresponding change in y.Then

  i) δy is called error in y.

  ii) $\frac{\delta y}{y}$ is called relative error in y.

  iii) $\frac{\delta y}{y}$ X 100 is called percentage error in y.
- If $y = f(x) = K.x^n$ then the approximate relative error (or percentage error) in y is 'n' times the relative error (or percentage error) in x where n and k are constants.

EX.3: Pressure 'p' and volume 'v' are connected by the relation pv^n = c (constant). Then the percentage error in the pressure is ___ times the percentage error in the decreasing volume.

Sol: Given $pv^n = c \Rightarrow p = c.v^{-n}$

$\therefore$ percentage error in pressure is **'n'** times the percentage error in the decreasing volume

↳ **Circle:** If r is the radius , x is the diameter , p is perimeter (circumference) and A is the area of a circle then

i) x = 2r

ii) $p = 2\pi r$ or $p = \pi x$

iii) $A = \pi r^2$ or A=$\frac{\pi x^2}{4}$

↳ **Sector:** If r is the radius, l is the length of the arc and θ is the angle , p is the perimeter and A is the area of a sector, then

i) $l = r\theta$

ii) $p = l + 2r$ or $p = r\theta + 2r = r(\theta + 2)$

iii) $A = \frac{1}{2}lr$ or $A = \frac{1}{2}r^2\theta$

↳ **Cube:** If x is the side , S is the surface area and V is the volume of a cube then

$\cdot S = 6x^2$ $\cdot V = x^3$

↳ **Sphere :** If r is the radius , S is the surface area V is the volume of a sphere then

$\cdot S = 4\pi r^2$ $\cdot V = \frac{4}{3}\pi r^3$

↳ **Cylinder :** If r is the radius (of cross section) h is the height , L is the lateral surface area, S is the total surface area, V is the volume of a cylinder (right circular) then

$\cdot L = 2\pi rh$, $S = 2\pi rh + 2\pi r^2$ $\cdot V = \pi r^2 h$

↳ **Cone:** If r is the base radius , h is the height, l is the slant height , θ is the semivertical angle α is the vertical angle , L is the lateral surface area , S is the total surface area and V is the volume of a (right circular) cone then

i) $l^2 = r^2 + h^2$, ii) $Tan\theta = \frac{r}{h}$

iii) $\alpha = 2\theta$, iv) $L = \pi rl$ (or) $L = \pi r\sqrt{r^2 + h^2}$

v) $S = \pi rl + \pi r^2$ vi) $V = \frac{1}{3}\pi r^2 h$

↳ **Simple pendulum:** If l is the length, T is the period of oscillation of a simple pendulum and g is the acceleration due to gravity then, $T = 2\pi\sqrt{l/g}$

↳ An electric current 'C' is measured by tangent galvonometer. If θ is the deflection of the galvonometer then $C \alpha Tan\theta$

MODULE-1
(CLASS WORK)

1. **If** $f(x) = \frac{x^2}{2} + 3x$ **where** $x = 2, \delta x = 0.05$ **then df =**

1) 2.5 2) 0.25 3) 2.635 4) 2.652

2. **If** $y = \frac{1}{x^2}; x = 1; \delta x = -0.01$ **then approximate error in 'y' is.**

1) -0.02 2) 2 3) 0.06 4) 0.02

3. **The approximate value of** $\sqrt{1.02}$ **is**

1) 1.01 2) 1.001 3) 1.0001 4) 1.1001

4. **The approximate value of** $\sqrt[5]{33}$ **is**

1) 2.0125 2) 2.1 3) 2.01 4) 3.258

5. **The approximate value is** $\cos 61^0$ **is**

1) 0.4848 2) 0.4849 3) 0.4948 4) 0.5059

6. ΔABC **is not a right angled and is inscribed in a fixed circle . If a, A,b,B be slightly varied keeping c, C fixed then** $\frac{\delta a}{\cos A} + \frac{\delta b}{cosB} =$

1) 2 2) 1 3) 0 4) 5

7. **If log4=1.3868 ,then the approximate value of log (4.01)**

1)1.3968 2)1.3898 3) 1.3893 4) 1.9338

8. **The diameter of a circle found by measurement 5.2cms with a maximum error 0.05cms. The maximum error in its area is**

1) 4.1 sq cms 2) 0.041 sq.cms
3) 0.41 sq.cms 4) 0.5 sq.cms

9. **A circular plate expands when heated from a radius of 5cms to 5.06 cm then the percentage increase in its area is**

1) 0.6 2) 1.2 3) 2.4 4) 0.12

10. In measuring the circumference 100cm of a circle, there is an error of 0.05 cm then the percentage error in its area is

1) $\frac{1}{10}$ 2) $\frac{1}{5}$ 3) $\frac{1}{100}$ 4) 1

11. When the radius of a sphere decreases from 3 cm to 2.98 cm then the approximate decrease in volume of sphere is

1) $0.002\pi cm^3$ 2) $0.072\pi cm^3$

3) $0.72\pi cm^3$ 4) $0.008\pi cm^3$

12. If the percentage error in the surface area of sphere is k, then the percentage error in its volume is

1) $\frac{3k}{2}$ 2) $\frac{2k}{3}$ 3) $\frac{k}{3}$ 4) $\frac{4k}{3}$

13. If an error of $\left(\frac{1}{10}\right)\%$ is made in measuring the radius of a sphere then percentage error in its volume is

1) 0.3 2) 0.03 3) 0.003 4) 0.0003

14. The area of square is 9sq cms and the error in its is 0.02 sq.cm The percentage error in the measurement of the length of the diagonal of the square is

1) $\frac{2}{9}$ 2) $\frac{1}{9}$ 3) $\frac{4}{9}$ 4) $\frac{1}{3}$

15. The height of a cylinder is equal to its radius. If an error of 1% is made in its height. Then the percentage error in its volume is

1) 1 2) 2 3) 3 4) 4

16. If the period of oscillation of a simple pendulum is increased by a% then the percentage increase in its length is

1) a/2 2) a 3) 2a 4) 1/2

17. Pressure P and Volume V of a gas are connected by the relation $PV^{\frac{1}{4}} = C$ (constant). The percentage increase in p corresponding to a diminition of $\frac{1}{2}\%$ in the volume is

1) 1/2 2) 1/4 3) 1/8 4) 1/16

18. The voltage E of a thermo couple as a function of temperature T is given by $E=6.2T+0.0002T^3$ when T changes from 100^0 to 101^0 the approximate change in E is

1) 12 2) 12.1 3) 12.12 4)12.2

19. The percentage error in measuring the side of a cube is 0.5 percentage error in volume is

1) 1/2 2) 1 3) 3/2 4) 2

20. If there is an error of $\pm 0.04cm$ in the measurement of the diameter of sphere then the percentage error in its volume, when radius is 10 cm (EAM-2014)

1) ± 1.2 2) ± 0.06 3) ± 0.006 4) ± 0.6

MODULE-1 KEY
(CLASS WORK)

01) 2	02) 4	03) 1	04) 1	05) 2	06) 3
07) 3	08) 3	09) 3	10) 1	11) 3	12) 1
13) 1	14) 2	15) 3	16) 3	17) 3	18) 4
19) 3	20) 4				

MODULE-1 HINTS
(CLASS WORK)

1. $df = f^1(x)\delta x$ **2.** $\delta f \cong f^1(x)\delta x$

3. $f(x) = \sqrt{x}, x = 1, \delta x = 0.02$

$f(x+\delta x) \square f(x) + f^1(x)\delta x$

4. $f(x) = \sqrt[5]{x}, x = 32, \delta x = 1$

$f(x+\delta x) \square f(x) + f^1(x)\delta x$

5. $f(x) = \cos x, x = 60, \delta x = 1^0$

$f(x+\delta x) \cong f(x) + f^1(x)\delta x$

6. $A+B+C = 180$

$\delta a = 2R\cos A\delta A, \delta b = 2R\cos B\delta B$

$a = 2R\sin A, b = 2R\sin B,\ \delta A + \delta B = 0$

7. $f(x) = \log x, x = 4, \delta x = 0.01$

$f(x+\delta x) \square f(x) + f^1(x)\delta x$

8. $\delta A \cong dA, A = \frac{\pi}{4}x^2, x =$ dia meter

9. $A = \pi r^2, r = 5, \delta r = 0.06$ **10.** $4\pi A = C^2$

11. $V = \frac{4}{3}\pi r^3, r = 3, \delta r = -0.02,\ \delta v \cong dv$

12. $V = \frac{1}{6\sqrt{\pi}}(s)^{3/2},\ V\% = \frac{3}{2}(s\%)$ **13.** $V\% = 3(S\%)$

14. A=9, $\ell = \sqrt{2}x$, $\delta A = 0.02$, $A = x^2$

$A = \frac{\ell^2}{2}, 1\% = \frac{1}{2}\frac{\delta A}{A} \times 100$

15 $h = r$ and $v = \pi h^3$, $V\% = 3(h\%)$

16. $T = 2\pi\sqrt{\frac{\ell}{g}}, T\% = \frac{1}{2}(\ell\%)$

17. $P\% = \left(\frac{-1}{2}\right)\left(\frac{-1}{4}\right)$

18. $T = 100^0, \delta T = 1$, $\delta E = 6.2\delta T + 0.0006T^2.\delta T$

19. $v = x^3$; $\frac{\delta v}{v} \times 100 = 3\left(\frac{\delta x}{x} \times 100\right)$

20. Given $\Delta r = \pm\frac{0.04}{2} = \pm 0.02; r = 10$

Volume, $V = \frac{4}{3}\pi r^3$

Take log on both sides & diff.

$\Rightarrow \frac{\Delta V}{V} \times 100 = 3.\frac{\Delta r}{r} \times 100 = \pm 0.6$

MODULE-2
(CLASS WORK)

1. The radius and height of a cone are measured as 6cms each by scale in which there is an error of 0.01 cm in each cm. Then the approximate error in its volume is

1) $216\pi c.c$ 2) $2.16\pi c.c$
3) $21.6\pi c.c$ 4) $0.216\pi c.c$

2. The height and slant height of a cone are measured as 15cms and 25cms. Errors 2% are to allowed in both of these lengths. The possible error in its volume is

1) 30π c.c 2) 60π c.c 3) 100π c.c 4) 120π c.c

3. If there is an error 0.04 sq.cms in the surface area of a sphere then the error in its volume when the radius is 30cms is

1) 0.06.c.c 2) 0.006c.c 3) 0.6 c.c 4) 0.0006 c.c

4. The area of triangle is measured in terms of b,c, A. If A=63^0 and there is an error of 15^1 in A; the percentage error in the area is

1) $\frac{5\pi}{36}\cot 63^0$ 2) $\frac{\pi}{36}\cot 63^0$
3) $\frac{2\pi}{36}\cot 63^0$ 4) $\frac{4\pi}{36}\cot 63^0$

5. In a triangle ABC, the sides b,c are given . If there is an error δA in measuring angle A. Then error δa in the side a is

1) $\frac{\Delta.\delta A}{2a}$ 2) $\frac{2.\Delta\delta A}{a}$ 3) $bc\sin A\delta A$ 4) $\frac{3.\Delta\delta A}{a}$

6. If there are 1%, 2%, 3%, 4% errors in r, r_1, r_2, r_3 then find the % error in area oftriangle

1) 10 2) 5 3) 6 4) 8

7. The focal length of a mirror is given by $\frac{1}{v} - \frac{1}{u} = \frac{2}{f}$. If equal errors α are made in measuring u and v. Then relative error in f is (EAM-2013)

1) $\frac{2}{\alpha}$ 2) $\alpha\left(\frac{1}{u} + \frac{1}{v}\right)$ 3) $\alpha\left(\frac{1}{u} - \frac{1}{v}\right)$ 4) $\frac{3}{\alpha}$

8. A circular hole of 4 cms diameter and 12 cms deep in a metal block is rebored to increase the diameter to 4.12 cm. then the amount of metal approximately removed is

1) $2.88\pi cu.cms$ 2) $3.99\ \pi\ cu.cms$
3) $3.79\ \pi\ cu.cms$ 4) $3.725\ \pi\ cu.cms$

9. A balloon is in the form of right circular cylinder of radius 1.5 m and length 4m and is surmounted by hemispherical ends. If the radius is increased by 0.01 m and the length by 0.05m, the percentage change in the volume of the balloon is

1) 2.389 2) 2.489 3) 2.0389 4) 2.589

10. If $1^0 = \alpha$ radians then the approximate value of $\cos(60^0 1')$ is

1) $\frac{1}{2} + \frac{\alpha\sqrt{3}}{120}$ 2) $\frac{1}{2} - \frac{\alpha}{120}$
3) $\frac{1}{2} - \frac{\alpha\sqrt{3}}{120}$ 4) $\frac{1}{2} + \frac{\alpha}{120}$

11. The relative error in the volume of a sphere due to the error in measuring the diameter is

K times the relative error in the diameter, then K is

1) 3 2) 2 3) 1 4) 4

12. The error in measuring the side of an equilateral triangle is 0.05. Then the percentage error in the area in terms of the side a is

1) 1/a 2) 10/a 3) 0.1/a 4) 5/a

MODULE-2 KEY
(CLASS WORK)

1) 2 2) 4 3) 3 4) 1 5) 2 6) 2
7) 2 8) 1 9) 1

MODULE-2 HINTS
(CLASS WORK)

1. $r = h = 6cm \Rightarrow \delta r = \delta h = 6(0.01) = 0.06cm$

$V = \frac{1}{3}\pi r^3 \Rightarrow \Delta V = \pi r^2 \Delta r$

2. h = 15cm, $\delta h = \frac{2h}{100}$, $l = 25cm \Rightarrow \delta l = \frac{2l}{100}$,

$v = \frac{1}{3}\pi r^2 h$, $\delta v = \frac{\pi}{3}\left(r^2\delta h + h.2r\delta r\right)$

3. $v = \frac{1}{6\sqrt{\pi}} s^{\frac{3}{2}}$

4. Area $S = \frac{1}{2}bc\sin A, A = 63^0, \delta A = 15^1$

$= \frac{15}{60}\times\frac{\pi}{180}$, $\frac{\delta s}{s}\times 100 = \cot A\ \delta A \times 100$

$= \cot 63 \times \frac{15}{60}\times\frac{\pi}{180}\times 100 = \frac{5\pi}{36}\cot 63^0$

5. $a^2 = b^2 + c^2 - 2bc\cos A, 2a\delta a = 2bc\sin A\delta A$

6. $\Delta^2 = rr_1r_2r_3$, $2\Delta\% = r\% + r_1\% + r_2\% + r_3\%$

7. $\delta x = \delta v = \alpha \Rightarrow \frac{-1}{v^2}\delta v + \frac{1}{u_2}\delta u = \frac{2}{f^2}\delta f$

8. D=4cm, h=12cm, $\delta D = 0.12cm$, $v = \pi r^2 h$

$\delta v = \pi h(2\delta r)$ (h is constant)

9. Volume $V = \pi r^2 h + \frac{2}{3}\pi r^3 + \frac{2}{3}\pi r^3$

$= \pi r^2 h + \frac{4}{3}\pi r^3$, Find $\frac{\delta v}{v}\times 100$

10. Let $f(x) = \cos x, x = 60^0, \delta x = 1' = \frac{1^0}{60} = \frac{\alpha}{60}$

$\delta f = \frac{df}{dx}\delta x = -\sin x.\delta x = -\frac{\sqrt{3}}{2}\times\frac{\alpha}{60} = -\frac{\alpha\sqrt{3}}{120}$

Also $f(x) = \cos 60^0 = \frac{1}{2}$

$\cos\left(60^0 1'\right) = f(x+\delta x) \cong f(x) + \delta f = \frac{1}{2} - \frac{\alpha\sqrt{3}}{120}$

11. diameter = $p = 2r$

$V = \frac{4}{3}\pi r^3 = \frac{\pi}{6}p^3$

$\log V = \log\frac{\pi}{6} + 3\log p \Rightarrow \frac{\delta v}{v} = 0 + \frac{3\delta p}{p}$

$\Rightarrow \frac{\delta v}{v} = \frac{3\delta p}{p} \Rightarrow k = 3$

12. Area = $A = \frac{\sqrt{3}a^2}{4}$

$LogA = \log\frac{\sqrt{3}}{4} + 2\log a$

$\frac{\delta A}{A}\times 100 \cong 2\times\frac{\delta a}{a}\times 100 = \frac{10}{a}$

MODULE-3

1. The approximate value of $(0.007)^{1/3}$

1) 0.1919 2) 0.1619 3) 0.1816 4) 0.1716

2. The approximate value of

$\sqrt{(1.97)^2 + (4.02)^2 + (3.98)^2}$

1) 5.99 2) 5.099 3) 5.009 4) 5.734

3. The approximate value of

$\left\{(3.92)^2 + 3(2.1)^4\right\}^{1/6}$

1) 2.0466 2) 2.755 3) 2.345 4) 2.732

4. In an acute angled triangle ABC, if sides a, b be constants and the base angles A and B vary then

1) $\frac{\delta A}{\sqrt{a^2-b^2\sin^2 A}}=\frac{\delta B}{\sqrt{b^2-a^2\sin^2 B}}$

2) $\frac{\delta A}{\sqrt{b^2-a^2\sin^2 A}}=\frac{\delta B}{\sqrt{a^2-b^2\sin^2 B}}$

3) $\frac{\delta A}{\sqrt{a^2\sin^2 A-b^2}}=\frac{\delta B}{\sqrt{a^2\sin^2 B-b^2}}$

4) $\frac{\delta A}{\sqrt{a^2+b^2\sin^2 A}}=\frac{\delta B}{\sqrt{b^2+a^2\sin^2 B}}$

5. With the usual meaning for a, b, c and s if Δ be the area of a triangle then the error in Δ resulting from a small error in the measurement of c, is

1) $\frac{\Delta}{4}\left(\frac{1}{s}+\frac{1}{s-a}+\frac{1}{s-b}-\frac{1}{s-c}\right)\delta c$

2) $\frac{1}{4}\left(\frac{1}{s}+\frac{1}{s-a}+\frac{1}{s-b}+\frac{1}{s-c}\right)\delta c$

3) $\frac{\Delta}{4}\left(\frac{1}{s}+\frac{1}{s-a}+\frac{1}{s-b}+\frac{1}{s-c}\right)\delta c$

4) $\left(\frac{1}{s}+\frac{1}{s-a}+\frac{1}{s-b}+\frac{1}{s-c}\right)\delta c$

6. The semivertical angle of a cone is 45^0 and the height of the cone is 20.025cm. The approximate value of the curved surface area is ___sqcm.

1) $401\sqrt{2}\pi$ 2) $400\sqrt{\pi}$

3) $\frac{400}{\sqrt{\pi}}$ 4) $\frac{401\sqrt{2}}{\pi}$

MODULE-3 KEY

1) 1 2) 1 3) 1 4) 1 5) 1 6) 1

MODULE-3 HINTS

1. $f=x^{1/3}$ taking $x=0.008\ \Delta x=-0.001$

2. $f=\sqrt{x^2+y^2+z^2}$ taking $x=2,y=4,z=4$

$\delta x=-0.03,\delta y=0.02,\delta z=-0.02,$

3. $x=4,y=2;\delta x=-0.08,\delta y=0.1$

$f\left(x^2+3y^4\right)^{1/6}$

4. $\frac{a}{\sin A}=\frac{b}{\sin B}$ differentiate

5. $\Delta=\sqrt{s(s-a)(s-b)(s-c)}$

$\log\Delta=\frac{1}{2}\left[\log s+\log(s-a)+\log(s-b)+\log(s-c)\right]$

where $S=\frac{a+b+c}{2}$

6. $h=r,h=20,\delta h=0.025$

Surface area $S=\pi rl=\pi r\sqrt{r^2+h^2}=\sqrt{2}\pi h^2$

$\delta S\cong\sqrt{2}\pi.2h.\delta h=2\pi(20)(0.025)\sqrt{2}=\pi\sqrt{2}$

Approximate value of the curved surface $=S+\delta S$

$=\pi h^2\sqrt{2}+\pi\sqrt{2}=400\pi\sqrt{2}+\pi\sqrt{2}=401\pi\sqrt{2}$

MODULE-1
(HOME WORK)

1. If f(x)= $3x^2-x$ where x =1 and $\delta x=0.02$ then δf =

1) 0.1012 2) 1.012 3) 0.101 4) 0.1

2. The differential of $f(x)=\sqrt{\frac{2-x}{2+x}}$ at x=0 and $\delta x=0.15$ is

1) 0.07 2) 0.075 3) -0.075 4) 015

3. The approximate value of $\sqrt{50}$ is

1) 7.0704 2) 7.0741 3) 7.0714 4) 7.0785

4. Approximate value of $\frac{1}{\sqrt[3]{8.08}}$ is

1) 0.49 2) 0.4983 3) 0.48 4) 0.483

5. If 1^0 =0.01745 radians .Then the approximate value of tan 46^0 is

1) 1.0259 2) 1.0394 3) 1.0349 4) 1.0493

6. If the sides of ΔABC are changed slightly but its circum radius remains constant then $\frac{\delta a}{\cos A}+\frac{\delta b}{\cos B}+\frac{\delta c}{\cos C}=$

1) 0 2) a+b+c 3) A+B+C 4) 2R

7. If $\log 3=1.0986$ then the approximate value

of $\log(3.01)$ is

1) 1. 1109 2) 1.1019 3) 1.0019 4) 1.1119

8. In a circle the relative error in the area is ... times the relative error in its circumference

1) 1 2) 2 3) 3 4) ½

9. If the relative error in the radius of a circle is 0.2 then the relative error in its area is

1) 0.2 2) 0.1 3) 0.4 4) 0.3

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

1) $\frac{2}{21}$ 2) $\frac{1}{7}$ 3) $\frac{2}{7}$ 4) $\frac{1}{14}$

11. The diameter of a sphere is measured to be 9cm with possible error of ± 0.05 cms. Then the relative error in the volume of sphere is

1) ± 1.67 2) ± 0.16

3) ± 0.0167 4) ± 0.000167

12. If there is an error 0.01 cm in the diameter of a sphere when its radius is 5 cm. The percentage error is its surface area = ...

1) 0.2 2) 0.6 3) 0.5 4) $\pi/10$

13. If there is an error of 0.01% in the radius of a sphere then the percentage error in its volume

1) 0.005 cu.cms 2) 0.05 cu.cms

3) 0.03 cu.cms 4) 0.2 cu.cms

14. The approximate increase in area of a square plate when the side expands from 3 cm to 3.01cm is

1) 0.001 sq .cms 2) 0.006 sq.cms

3) 0.06 sq .cms 4) 0.01 sq .cms

15. The radius and height of a cylinder are measured as 5 cm and 10 cm and there is an error of 0.02 cm in both the measurements then the error in its volume is

1) 2.5π c.c. 2) 25π c.c

3) 0.25π c.c 4) 0.025π c.c

16. If the length of simplependulum decreases by 3% then the percentage error in the period T is decreased by

1) 2 2) 2.5 3) 1.8 4) 1.5

17. The pressure p and volume v of a gas are connected by the relation PV=C (constant). If δp and δv are the errors respectively in p and v.Then the approximate value of $\frac{C.\delta v}{v^2}$ is

1) $-\delta p$ 2) δp 3) $\frac{1}{\delta p}$ 4) $\frac{-1}{\delta p}$

18. In a tangent galvanometer the current is proportional to the tangent of angle of deflection. If the defelction is 45^0 and error of 1% is made in reading it , the percentage error in the current is

1) π 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{3}$ 4) $\frac{\pi}{4}$

19. If an error of 1^0 is made in measuring the angle of a sector of radius 30 cms. The approximate error in its area.....sq.cms is

1) π 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{3}$ 4) $\frac{\pi}{4}$

20. The radius and height of a cylinder are measured as 5cm and 10cm and there is an error of 0.02cm in both the measurements, then the error in its volume is ____ cub.cms

1) 2.5π 2) 25π 3) 0.25π 4) 0.025π

MODULE-1 KEY
(HOME WORK)

01) 1	02) 3	03) 3	04) 2	05) 3	06) 1
07) 2	08) 2	09) 3	10) 4	11) 3	12) 1
13) 3	14) 3	15) 1	16) 4	17) 1	18) 2
19) 3	20) 1				

MODULE-1 HINTS
(HOME WORK)

1. $\delta f = f(x+\delta x) - f(x)$
2. use formula $df = f^1(x)\delta x$
3. $f(x) = \sqrt{x}, x = 49, \delta x = 1$

   $f(x+\delta x) \cong f(x) + f^1(x)\delta x$
4. $f(x) = \frac{1}{\sqrt[3]{x}}, x = 8, \delta x = 0.08$

   $f(x+\delta x) = f(x) + f^1(x)\delta x$
5. $f(x) = \tan x, x = 45^0, \delta x = 1^0$
6. $A+B+C = 180^0$, $\delta A + \delta B + \delta C = 0$

   $a = 2R\sin A$, $b = 2R\sin B$, $c = 2r\sin C$

   $\delta a = 2R\cos A\delta A$, $\delta b = 2R\cos B\delta B$

   $\delta c = 2R\cos C\delta C$, $\frac{\delta a}{\cos A} = 2R\delta A$,

$\frac{\delta b}{\cos B}=2R\delta B,\ \frac{\delta c}{\cos C}=2R\delta C,$

$\frac{\delta a}{\cos A}+\frac{\delta b}{\cos B}+\frac{\delta c}{\cos C}=2R(\delta A+\delta B+\delta C)=2R(0)=0$

7. Let $f(x)=\log x \Rightarrow x=3;\ \delta x=0.01$

$\therefore \log(3.01)=f(x)+f'(x).\delta x$

$=1.0986+\frac{0.01}{3}=1.0986+0.0033=1.1019$

8. Observe the formula $4\pi A=C^2$

9. $A=\pi r^2$

10. $4\pi A=c^2,\ A\%=2\frac{\delta c\times 100}{c}$

11. $\frac{\delta v}{v}=3.\frac{\delta x}{x}$, x = diameter

12. $s=4\pi r^2,\ \frac{\delta s}{s}\times 100=2\left(\frac{\delta r}{r}\times 100\right)$

13. $V=\frac{4}{3}\pi r^3 \Rightarrow V\%=3r\%$

14. $A=x^2, x=3cm, \delta x=0.01cm$

15. $V=\pi r^2 h,\ \delta v=\pi\left[2rh\delta r+r^2\delta h\right]$

16. $T=2\pi\sqrt{\frac{\ell}{g}}$

17. $pv=c \Rightarrow p\delta v+v\delta p=0;\ c\frac{\delta v}{v^2}=p\frac{\delta v}{v}=-\delta p$

18. $c\alpha\tan\theta, c=k\tan\theta;\ \frac{\delta\theta}{\theta}\times 100=1\Rightarrow\delta\theta=\frac{\theta}{100}$

19. $A=\frac{1}{2}r^2\theta$

20. $V=\pi r^2 h$

$\delta v=\pi\left[2rh\delta r+r^2\delta h\right]$

MODULE-2
(HOME WORK)

1. The radius and height of a cone are measured as 8cm , 8cm by a scale in which there is an error of 0.01cm in each cm. The error in the volume of the cone is

1) 512π c.c 2) 51.2π c.c
3) 5.12π c.c 4) 0.512π c.c

2. If the ratio of the base radius and height of a cone is 1:2 and percentage error in the radius is k then percentage error in volume is

1) k 2) 2k 3) 3k 4) 4k

3. The radius of a cylinder is half of its height. Error in the measurement of the raidus is 0.5% then percentage error in its surface area is

1) 5 2) 1 3) 1.5 4) 2

4. The area of a triangle is calculated by 1/2 bcsinA. The angle A is found to be 30^0 with an error of 10 minutes then the percentage error in its area is

1) 0.504 2) 0.5 3) 5.04 4) 0.54

5. The length of a wire is 3 cms and the error in it is 0.01 cm. If the wire is bent to form an equilateral triangle, error in its area is

1) 0.01 2) $\frac{0.1}{2\sqrt{3}}$ 3) $\frac{0.01}{\sqrt{3}}$ 4) $\frac{0.01}{2\sqrt{3}}$

6. The possible percentage error in computing the parallel resistance R of three resistances R_1, R_2, R_3 from the formula $\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$, if R_1, R_2, R_3 are each in error by 1.2%

1) 1.2 2) 1.3 3) 1.3 4) 1.7

7. The distance S travelled by a particle is calculated using the formula $S=ut-\frac{1}{2}at^2$. If there is 1% error in t, the approximate percentage error in S is

1) $\left(\frac{u-at}{2u-at}\right)$ 2) $2\left(\frac{u-at}{2u-at}\right)$ 3) $\frac{1}{2}\left(\frac{u-at}{2u-at}\right)$ 4) $\left(\frac{u-at}{3u-at}\right)$

8. In measuring the circumference of a circle, there is an error of 0.05 cm. If with this error the circumference of the circle is measured as c cm, then the error in area is

1) $\frac{0.025c}{\pi}$ sq cm 2) $\frac{0.25c}{\pi}$ sq cm
3) $\frac{0.0025c}{\pi}$ sq cm 4) $\frac{0.00025c}{\pi}$ sq cm

9. The maximum error in T due to possible errors upto 1% in l and 2.5% in g where period T of

a simple pendulum is $T = 2\pi\sqrt{l/g}$

1) 1.75% 2) 1.57% 3) 1.68% 4) 1.73%

10. The approximate change in the total surface area of a right circular cone whne the radius 'r' remains constant while altitude 'h' changes by 'α' is

1) $\frac{\pi rh\alpha}{\sqrt{r^2+h^2}}$ 2) $\frac{\pi rh}{\sqrt{r^2-h^2}}$

3) $\frac{\pi rh\alpha}{\sqrt{r^2-h^2}}$ 4) $\frac{\pi h\alpha}{\sqrt{r^2+h^2}}$

11. A variable 'x' varies from 450 to 460 and the other variable 'y' decreases from 200 to 190 in a certain period of time. If u = xy then change in u' during that period is

1) -2500 2) 2500 3) 3500 4) -1500

12. An electric current 'C' is measured by tangent galvanometer. The relative error in the current correesponding to an error $\delta\theta$ in its angle of deflection is

1) $\sec\theta.\delta\theta$ 2) $\operatorname{cosec}\theta.\delta\theta$

3) $\tan\theta.\delta\theta$ 4) $\sec\theta\operatorname{cosec}\theta.\delta\theta$

MODULE-2 KEY
(HOME WORK)

1) 3 2) 3 3) 2 4) 1 5) 4 6) 1

7) 2 8) 1 9) 1 10) 1 11) 1 12) 4

MODULE-2 HINTS
(HOME WORK)

1. $v = \frac{1}{3}\pi r^2 h,\ \delta v = \frac{\pi}{3}\left[r^2\delta h + 2hr\delta r\right]$

2. $\frac{r}{h} = \frac{1}{2}, r\% = k,$

$v = \frac{1}{3}\pi r^2 h,\ v = \frac{2}{3}\pi r^2 h,$ v % =3r% =3k.

3. $r = \frac{h}{2}, s = 2\pi rh + 2\pi r^2$

$r\% = 0.5\%\ s = 6\pi r^2,\ s\% = 2r\%$

4. $A = 30^0, B = \frac{1}{2}bc\sin A$

$\delta A = \frac{1}{6}(0.01745),\ \Delta\% = \cot A.\delta A(100)$

5. $\ell = 3x, A = \frac{\sqrt{3}}{4}x^2,\ x = \frac{\ell}{3}, A = \frac{\sqrt{3}}{4}\frac{\ell^2}{9}$

6. $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

differentiation on both sides

$$-\frac{1}{R^2}\Delta R = -\frac{1}{R_1^2}\Delta R_1 - \frac{1}{R_2^2}\Delta R_2 - \frac{1}{R_3^2}\Delta R_3$$

Find $\frac{\Delta R}{R}\times 100$

7. taking logarithms and differentiate

8. $2\pi r = c,\ \delta c = 0.05cm,\ r = \frac{c}{2\pi},\ sr = \frac{0.05}{2\pi}$

$$\delta A = 2\pi r.sr = 2\pi.\frac{c}{2\pi}.\frac{0.05}{2\pi} = \frac{0.025c}{\pi}$$

9. $T = 2\pi\sqrt{l/g}$

$\log T = \log 2\pi + 1/2\log l - 1/2\log g$

10. Given $\delta h = \alpha$, let total surface area

$S = \pi rl = S = \pi r\sqrt{r^2+h^2}$

$$\delta S = \pi r = \frac{1}{2\sqrt{r^2+h^2}}\times 2h\times\delta h$$

$$= \frac{\pi rh\alpha}{\sqrt{r^2+h^2}}$$

11. $x = 450; \delta x = 10; y = 200, \delta y = -10$

$u = xy \Rightarrow \delta u = x\delta y + y\delta x$

$= 150(-10) + 200(10) = -2500$

12. $c = k\tan\theta\ (k \in R)$

$\delta c = k\sec^2\theta.\delta\theta$