ERRORS AND APPROXIMATIONS

- INFINITESIMALS : If x is a quantity δ_x (change in x) is a small quantity when compared to x and $x\delta x, x\delta x^2, x\delta x^3, \dots$ are small quantities (when compared to x and δ_x) in the decreasing order of magnitude, then these quantities are called infinitesimals of order 1, order 3 and so on.
- If y = f(x), δx is any change in x then the coresponding change in y is δy . it is given by

$$\delta y = f(x + \delta x) - f(x)$$

• $\frac{dy}{dx}\delta x$ is called differential of y It is denoted by

dy or df. : dy=df= $f^1(x)\delta x$

• The approximate value of the function is $f(x+\delta x)$.

$$\therefore f(x+\delta x) \cong f(x)+f^{1}(x)\delta x$$

- $\delta y \cong dy$
- 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

- δy is called error in y.
- $\frac{\delta y}{y}$ is called relative error in y.
- $\frac{\delta y}{y}$ (100) is called percentage error in y.
- Circle : If r is the radius , x is the diameter , p is perimeter (circumference) and A is the area of a circle then
 - x=2r

•
$$p = 2\pi r$$
 or $p = \pi x$

- $A = \pi r^2$ 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

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

•
$$A = \frac{1}{2}lr$$
 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

• $S = 6x^2$ • $V = x^3$

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

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

- 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 (right circular) then
 - $L = 2\pi rh$

•
$$S = 2\pi rh + 2\pi r^2$$

- $V = \pi r^2 h$
- 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
 - $l^2 = r^2 + h^2$
 - $Tan\theta = \frac{r}{h}$ • $\alpha = 2\theta$ • $L = \pi rl$ or $L = \pi r\sqrt{r^2 + h^2}$ • $S = \pi rl + \pi r^2$ • $V = \frac{1}{2}\pi r^2 h$
- 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, $T = 2\pi \sqrt{l/g}$

1.	LEVEL-I . If $f(x)=3x^2 - x$ where $x = 1$ and $\delta x = 0.02$ then			If there is an error of 0.05 cms in measuring t circumference 'C' of a circle then the approxim error in its area is			
	$\delta f =$ 1. 0.1012 2. 1.012	3. 0.101 4. 0.1		$1.\frac{40\pi}{C}$	2. $\frac{10\pi}{C}$	3. $\frac{C}{10\pi}$	4. $\frac{C}{40\pi}$
2.	If $f(x) = x^2 + x + 1$ then $\delta f =$	where $x = 2$, $\delta x = 0.01$	13.	If the relati then the rel	ve error in t ative error in	he radius of 1 its area is	a circle is 0.2
3.	1. 0.0501 2. 0.05 If $f(x) = f(x) = \frac{x^2}{2}$	3. 0.005 4. 0.0051 $x^{2} + 3x$ where	14.	1. 0.2 A circular radius of 5 increase in	2.0.1 e plate expa cms to 5.06 its area is	3.0.4 nds when h cm then th	4.0.3 eated from a se percentage
	$x = 2, \delta x = 0.05$ the 1.2.5 2.0.25	n df= 3.2.635 4.2.652	15.	1.0.6 In a circle t the relative	2.1.2 he relative e error in its c	3. 2.4 error in the an	4. 0.12 rea is times e
4.	The approximate char $x = 3$, $\delta x = 0.01$ is	nge in 'y' when $y = x^2 + 2x$,		1.1	2.2	3.3	$4.\frac{1}{2}$
5.	1.3.6 2.2.0 If $f(x) = \log x, x=2$,	3. 0.08 4. 0.3 $\delta x = 0.02$ then $\delta f - df =$	16.	In measurir there is an error in its	cm of a circle, le percentage		
	1. log(1.01) 3. 0.01	2. $\log(1.01) - 0.01$ 4. 1.02		$1.\frac{1}{10}$	2. $\frac{1}{5}$	3. $\frac{1}{100}$	4. 1
6.	If $y = \log x$ where $x = absolute error in y $ is	3, $\delta x = 0.03$ then the	17.	A sphere o 98cms. The	A sphere of radius 100 cms reduces to radius of 98cms. The approximate decrease in its volume is		
	1. 0.01 2. 0.009	3. 0.0091 4. 0.0099		1.12000πα	С.С	2. $800\pi c$.	С
7.	$e^2 = 7.389$; the appr	oximate value of $e^{2.1}$ is		3.80000 <i>π</i>	с.с	4.8000πc	<i>c.c</i>
8	1. 7.689 2. 8.127 $log_3 = 1.0986$ then f	9 3. 8.2179 4. 8.2178	18.	If an error	of $\left[\frac{1}{10}\right]\%$	is made in n	neasuring the
0.	log(9.01) is	3 3. 2.1389 4. 2.1789		radius of a volume is	sphere then	percentag	e error in its
9.	If $y = k x^n$ (k is constational is times the relative 1.1 2. n	(not) the relative error in 'y' e error in x 3. (n-1) 4. $\frac{1}{n}$	19.	1.0.3 If there is a a sphere the the radius i	2.0.03 in error of 0. en the percent s 10 cms is 2.0.2	3. 0.003 02 cms in th tage error in	4. 0.0003 e diameter of volume when
10.	The approximate incr when the side expand	<i>n</i> ease in area of a square plate ls from 3 cm to 3.01 cm is	20.	If the percer is k, then th	ntage error in ne percentag	the surface are error in its	area of sphere volumes is
	1. 0.001 sq .cms 3. 0.06 sq .cms	2. 0.006 sq.cms 4. 0.01 sq .cms		1. $\frac{3k}{2}$	2. $\frac{2k}{3}$	3. $\frac{k}{3}$	4. $\frac{4k}{3}$
11.	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 is		21.	The radius 0.02cms is surface are	of a sphere i made in the a is	is 5 cm .If ar radius then t	n error of the error in its
	1. 50π sq.cms	2.25π sq.cms		$1.0.8\pi$ sq.0	cm	2. 8π sq.c	m
	3. 2.5π sq.cms	4.75 π sq.cms		$3.0.4\pi$ sq.0	cm	4. 4π sq.c	m

22.	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	31.	If the period of oscillation of a simple pendulum is increased by a% then the percentage increase in its length is				
	1. ±1.67 2. ±0.16		1. a/2 2. a 3. 2a 4. 1/2				
	3. ±0.0167 4. ±0.000167	32.	While measuring the side of an equilateral triangle				
23.	The diameter of a circle found by measurement		an error of 0.5% is made . The percentage error in				
	5.2cms with a maximum error 0.05cms. The		its area is				
	maximum error in its area is		1.1 2.1.5 3.2 4.2.5				
	1.4.1 sq cms 2. 0.041 sq.cms	33.	In an equilateral triangle whose side is 'x and Area				
24.	The height of a cylinder is equal to its radius. If an error of 1% is made in its height. Then the		$A_1, \frac{\delta A}{A} =$				
	percentage error in its volume is		$\delta x = 1 \delta x$				
	1.1 2.2 3.3 4.4		$1. \frac{1}{x}$ $2. \frac{1}{2} \cdot \frac{1}{x}$				
25.	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		3. 2. $\frac{\delta x}{x}$ 4. $\pi \cdot \frac{\delta x}{x}$				
	volume is	34.	An electric current 'C' is measured by tangent				
	1. 2.5π 2. 25π 3. 0.25π 4. 0.025π		galvanometer. The relative error in the current 'C"				
26.	If $y = x^n$ then the rati of the relative error in y		corresponding to an error $\delta\theta$ in the angle of				
	and x are		deflection θ is				
	1. 1:1 2. 2:1 3. <i>n</i> :1 4. 1: <i>n</i>		1. $S \in \theta.\delta\theta$ 2. $\cos ec \theta.\delta\theta$				
27.	If S=1/2 ab sinC and K is the error in C then		3. $\tan \theta . \delta \theta$ 4. $\sec \theta . \cos e c \theta . \delta \theta$				
	relative error in 'S' is 1. K cot C 2. K TanC		In a tangent galvanometer the current is propor-				
			tional to the tangent of angle of deflection. If the				
	3. K $\cos C$ 4. K $\sin C$		defelction is 45° and error of 1% is made in reading				
28.	Pressure P and Volume V of a gas are connected		it, the percentage error in the current is				
	by the relation $PV^{\frac{1}{4}} = C$ (constant). The percentage increase in p corresponding to a		1. π 2. $\frac{\pi}{2}$ 3. $\frac{\pi}{3}$ 4. $\frac{\pi}{4}$				
	1	36.	The relative error in $v = a^x$ at a=5.x=4 $\delta x = 0.1$				
	diminition of $\frac{1}{2}$ % in the volume is		is				
	1. $\frac{1}{2}$ 2. $\frac{1}{4}$ 3. $\frac{1}{8}$ 4. $\frac{1}{16}$		1. $\log 5$ 2. (0.1) $\log 2$				
29.	Pressure 'p' the volume 'V' are connected by the		$3.\log 2$ 4. (0.1) log 5				
	relation $PV^n = C$ (constant) then the percentage error in the pressure istimes the percentage error in the decreasing volume	37.	If an error of 1% made in measuring the major and minor axes of an ellipse then the percentage error in its area is				
	1. 2 2.n 3n 4. n/2		$1, \frac{1}{2}, \frac{3}{2}, \frac{3}{2}, \frac{3}{2}, \frac{1}{2}, \frac{4}{2}$				
30.	When the radius of a sphere decreases from 3		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2				
	cm to 2.98 cm then the approximate decrease in volume of sphere is		A varibale x varies from 450 to 460 and other varibale y decreases from 200 to 190 in a certain				
	1. $0.002 \pi cm^3$ 2. $0.072 \pi cm^3$		period of time. If u=xy then change in 'u' during that period is				
	3. $0.72 \pi cm^3$ 4. $0.008 \pi cm^3$		12500 2. 2500 3.3500 41500				
		1					

39.	The diff	erential o	of $f($	$x = \sqrt{\frac{2}{2}}$	$\frac{1}{x}$ at x=0 and				
	$\delta x = 0.1$ 1.0.07	5 is 2. 0.0)75 3	v 2 +	4.015				
40.	If $y = \frac{1}{2}$	$;x=1;\delta x=1$	=-0.01	then appr	oximate error				
	$\frac{1}{x^2}$								
	10.02	2.2		3. 0.06	4.0.02				
KEY									
	1.1	2.1	3.2	4.3	5.2				
	6.1	7.2	8.1	9.2	10.3				
	11.3	12.4	13.3	14.3	15.2				
	16.1	17.3	18.1	19.3	20.1				
	21.1	22.3	23.3	24.3	25.1				
	26.3	27.1	28.3	29.2	30.3				
	31.3	32.1	33.3	34.4	35.2				
	36.4	37.4	38.1	39.3	40. 4				
		F	HINT	S					
1. δ	f = f(x +	$+\delta x - f$	$\hat{x}(x)$						
2. δ	f = f(x +	$+\delta x - f$	$\hat{x}(x)$						
3. d	$f = f^1(x)$. δx							
7.	f(x) =	$e^x, x=2,$	$\delta x =$	0.1					
	$f(x+\delta)$	$f(x) \cong f(x)$	(x) + f	$^{1}(x)\delta x$					
9.	Power of	f x times	,						
10.	$A=x^2, x$	$c=3cm,\delta$	x = 0.0)1 <i>cm</i>					
11.	$A = \frac{1}{2}r^2$	θ							
12.	$4\pi A = 0$	2^{2}							
13.	$A = \frac{C^2}{4\pi}$								
15.	Observe	the formu	ıla 4 π	$A = C^2$					
16	Same as	15 hint							
17.	$V = \frac{4}{3}\pi$	r^3							
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18.	V% = 3(r%)
20.	$V = \frac{1}{6\sqrt{\pi}} \left(S\right)^{\frac{3}{2}}$
	$V\% = \frac{3}{2}(S\%)$
21.	$S = 4\pi r^2$
24.	$h = r and V = \pi h^3$
	V% = 3(h%)
25.	$V = \pi r^2 h$
	$\delta V = \pi \Big[2rh\delta r + r^2 .\delta h \Big]$
28.	$P\% = \left(-\frac{1}{2}\right)\left(-\frac{1}{4}\right)$
29.	V% = -ve, P% = -(-n) = n
31.	$T = 2\pi \sqrt{\frac{l}{g}}, T\% = \frac{1}{2}(l\%)$
32.	$A = \frac{\sqrt{3}}{4}x^2, A\% = 2(x\%)$
34.	$C \propto Tan\theta$, $C = KTan\theta$
	Taking logarithems on both sides
35.	Same as 34 hint
	$\frac{\delta\theta}{\theta} \times 100 = 1 \Longrightarrow \delta\theta = \frac{\theta}{100}$
37.	Area of Ellipse $A = \pi ab$
	$\frac{\delta A}{A} \times 100 = \left(\frac{\delta a}{a} \times 100\right) + \left(\frac{\delta b}{b} \times 100\right)$
	=1% + 1% = 2%
39.	Use fomulae
	$f^{1}(x) \times \delta x$
	LEVEL-II
1	The approximate value of $\sqrt{50}$ is

The approximate v	value of $\sqrt{50}$ is
1.7.0704	2. 7.0741
3. 7.0714	4. 7.0785

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ERRORS & APPROXMATION

2.	If $1^{\circ} = 0.01745$ radians .Then the approximatevalue of $\tan 46^{\circ}$ is1. 1.02592.1.0394	14.	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		
	3. 1.0349 4. 1.0493		$1.512\pi c.c$ $2.51.2\pi c.c$		
3.	The approximate value is $\cos 61^{\circ}$ is		3. $5.12\pi c.c$ 4. $0.512\pi c.c$		
	1. 0.48482. 0.48493. 0.49484.0.5059	15.	The circumference of a circle is measured as 28cm with an error of 0.01 cms. Then the percentage		
4.	The approximate value of $\sqrt{1.02}$ is		error in the area of the circle is		
	1. 1.012. 1.0013. 1.00014. 1.1001		1. $\frac{2}{21}\%$ 2. $\frac{1}{7}\%$ 3. $\frac{2}{7}\%$ 4. $\frac{1}{14}\%$		
5.	The approximate value of $\sqrt[5]{33}$ is 1.2.0125 2.2.1 3.2.01 4.3.258	16.	If there is an error of 0.01 cms in the diameter of a sphere then the percentage error in the surface area when the radius is 5 cm is		
6	The approximate value of $\sqrt{4.09}$ is		1.0.005 sq.cms 2. 0.05 sq.cms		
	1201 2202 3203 4208		3. 0.1 sq.cms 4. 0.2 sq.cms		
7.	If log4=1.3868. Then the approximate value of log (4.01)	17.	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		
	1.1.3968 2.1.3898 3.1.3893 4. 1.9338		1.0.06.c.c 2. 0.006c.c		
8.	The approximate alue of $\sqrt[4]{17}$ is		3. 0.6 c.c 4. 0.0006 c.c		
9.	1. 2.03132.2.01363.2.1234.1.2321The voltage E of a thermo couple as a function of temperature T is given by	18.	A circular hole of 4 cms diameter and 12 cms de in a metal block is rebored to increase the diam to 4.12 cm. then the amount of met		
	$E = 6.2T + 0.0002T^3$ when T charges from 100°		approximately removed is		
	to 101^0 the approximate change in E is		1. $2.88\pi sq.cms$ 2. $3.99 \pi sq.cms$		
	1. 12 2.12.1 3.12.12 4.12.2		3. 3.79 π sq.cms 4. 3.725 π sq.cms		
10.	Approximate value of $\frac{1}{\sqrt[3]{8.08}}$ is	19.	The pressure p and volume v of a gas are connected by the relation $pv=C$ (constant). If δp		
	1. 0.49 2.04983 3.048 4. 0.483		and δ_V are the errors respectively in p and v. Then		
11.	Approximate value of $\sqrt[3]{63}$ is		the approximate value of $\frac{C.\delta v}{v^2}$ is		
12.	1. 3.972 2. 4.028 3. 3.979 4. 7.972 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	20.	1. $-\delta p$ 2. δp 3. $\frac{1}{\delta p}$ 4. $\frac{-1}{\delta p}$ In a triangle ABC, the sides b,c are given. If there is an error $\delta 4$ in measuring angle A. Then error		
	1. $216\pi c.c$ 2. $2.16\pi c.c$		δ_a in the side a is		
	3. $21.6\pi c.c$ 4. $0.216\pi c.c$		$\Lambda \delta A \qquad 2 \Lambda \delta A$		
13.	If the ratio of the base radius and height of a cone is 1:2 and percentage error in the radius is k		1. $\frac{\Delta O A}{2a}$ 2. $\frac{2 \Delta O A}{a}$		
	then percentage error in volume is1. k2. 2k3. 3k4. 4k		3. $bc \sin A\delta A$ 4. $\frac{3.\Delta\delta A}{a}$		
					

21.	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 $\frac{\delta a}{\partial a} + \frac{\delta b}{\partial a \partial B} =$							
	$\cos A \cos B$ 1. 2 2.1 3.0 4.5							
22.	The length of a wire is 3 cms and the error in it i 0.01 cm. If the wire is bent to form an equilateria triangle the error in its area is	s 15.						
	1.0.01 2. $\frac{0.1}{2\sqrt{3}}$ 3. $\frac{0.01}{\sqrt{3}}$ 4. $\frac{0.01}{2\sqrt{3}}$	17.						
23.	The focal length of a mirror is given by $\frac{1}{v} - \frac{1}{u} = \frac{2}{f}$	18.						
	If equal errors α are made in measuring u and v Then relative error in f is	7.						
	$1.\frac{2}{\alpha} \qquad 2. \ \alpha \left(\frac{1}{u} + \frac{1}{v}\right) 3.$	20.						
	$\alpha\left(\frac{1}{u}-\frac{1}{v}\right) \qquad 4. \ \frac{3}{\alpha}$	21.						
	KEV							
	1.3 2.3 3.2 4.1 5.1	22.						
	6.2 7.3 8.1 9.4 10.2							
	11.3 12.2 13.3 14.3 15.4 16.4 17.2 18.1 10.1 20.2							
	16.4 17.3 18.1 19.1 20.2 21.3 22.4 23.2	23.						
	HINTS							
1.	$f(x) = \sqrt{x}, x = 49, \delta x = 1$							
	$f(x+\delta x); f(x)+f^{1}(x).\delta x$	1.						
2.	$f(x) = Tanx; x = 45^{\circ}; \delta x = 1^{\circ}$							
5.	$f(x) = \sqrt[5]{x}; x = 32; \delta x = 1$							
7.	$f(x) = \log x; x = 4, \delta x = 0.01$							
9.	$T=100^{\circ}; \delta T=1^{\circ}$	2.						
	$\delta E = 6.2\delta T + 0.0006T^2.\delta T$							
12.	$r = h = 6cm \Longrightarrow \delta r = \delta h = 6(0.01) = 0.06 cm$							
	$V = \frac{1}{3}\pi r^2 h \Longrightarrow \delta V = \frac{\pi}{3} \left(r^2 \delta h + h.2r.\delta r \right)$							
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13.
$$\frac{r}{h} = \frac{1}{2}, r^{\phi_{0}} = K; V = \frac{1}{3}\pi r^{2}h$$

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

$$V^{\phi_{0}} = 3r^{\phi_{0}} = 3k$$
15.
$$4\pi A = C^{2}$$

$$A^{\phi_{0}} = 2\frac{\delta C}{C} \times 100$$
17.
$$V = \frac{1}{6\sqrt{\pi}}S^{\frac{3}{2}}$$
18.
$$D=4\text{cm}, h=12 \text{ cm}, \delta D = 0.12cm$$

$$V = \pi r^{2}h$$

$$\delta V = \pi h(2\delta r) \text{ (h is constant)}$$
20.
$$a^{2} = b^{2} + c^{2} - 2bc \cos A$$

$$2a\delta a = 2bc \sin A\delta A$$
21.
$$A + B + C = 180^{\circ} \qquad a = 2R \sin A$$

$$b = 2R \sin B$$

$$\delta A + \delta B = 0$$

$$\delta a = 2R \cos A\delta A \quad \delta b = 2R \cos B\delta A$$
22.
$$I=3x \qquad A = \frac{\sqrt{3}}{4}x^{2}$$

$$x = \frac{l}{3} \qquad A = \frac{\sqrt{3}}{4}.\frac{l^{2}}{9}$$
23.
$$\delta x = \delta v = \alpha$$

$$\Rightarrow \frac{-1}{V^{2}}\delta v + \frac{1}{u^{2}}\delta u = \frac{2}{f^{2}}\delta f$$
LEVEL - III
1. The semi vertical angle of a cone is 45^{\circ}. If the height of the cone is 20.025 cms. Then the approximate value of its lateral surface area is

2. 401π sq.cms 1. 400π sq.cms

3. $401\sqrt{2}\pi \ sq.cms$ 4. $402\sqrt{2}\pi \ sq.cms$

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.	$30\pi c.c$	2.	60 <i>πc.c</i>
3.	100 <i>πc.c</i>	4.	120 <i>πc.c</i>

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3. 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. $\frac{1}{3}$ If the sides of $\triangle ABC$ are changed slightly but its 4. 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 5. The area of a triangle is calculated by 1/2 bcsinA. The angle A is found to be 30° 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 6 The area of triangle is measured in terms of b,c, A. If $A=63^{\circ}$ and there is an error of 15° in A; the percentage error in the area is 1. $\frac{5\pi}{36}\cot 63^{\circ}$ 2. $\frac{\pi}{36}\cot 63^{\circ}$ 3. $\frac{2\pi}{36} \cot 63^{\circ}$ 4. $\frac{4\pi}{36} \cot 63^{\circ}$ 7. 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 8. If there are 1%, 2%, 3%, 4% errors in r, r_1, r_2, r_3 then find the % error in area of triangle 1.10% 2.5% 4.8% 3.6% 9. The distance S traveled 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. $\left(\frac{u-at}{3u-at}\right)$ **KEY** 1.3 2.4 3.2 4.1 5.1 7.2 6.1 8.2 9.2

HINTS

1.
$$\alpha = 45^{\circ}, x = 20 \text{ cm}, \delta x = 0.025 \text{ cm}$$

L.S.A= $f(x) = \sqrt{2\pi x^2}$
 $f(x + \delta x); f(x) + f^1(x) \delta x$
2. $h = 15 \text{ cm}, \delta h = \frac{2h}{100}$
 $l = 25 \text{ cm} V = \frac{1}{3} \pi r^2 h$
 $\delta l = \frac{21}{100}, \delta V = \frac{\pi}{3} (r^2 \delta h + h.2r \delta r)$
3. $A = 9$ $l = \sqrt{2}x$
 $\delta A = 0.02, A = x^2$
 $A = \frac{l^2}{2}$ $1\% = \frac{1}{2} \frac{\delta A}{A} \times 100$
5. $A = 30^{\circ}$ $B = \frac{1}{2} \text{ bc sin } A$
 $\delta A = \frac{1}{6} (0.01745)$
 $\Delta\% = \cot A.\delta A (100)$
7. $r = \frac{h}{2}$ $S = 2\pi rh + 2\pi r^2$
 $r\% = 0.5\% S = 6\pi r^2$ $S\% = 2r\%$
8. $\Delta^2 = r.r_1 r_2 r_3$
 $2\Delta\% = r\% + r_1\% + r_2\% + r_3\%$
9. Taking logarthms and differentiate
LEVEL - 4
1. Which of the following statements are true

I: If
$$f(x) = x^2$$
, $x = 10$, $\delta x = 0.1$ then
 $\delta f = 2.01$
II: If $f(x) = x^2$, $x = 10$, $\delta x = 0.1$ then $df = 2$
1. only I 2. only II
3. both I and II 4. neither I nor II

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2.	Which of the following statements are true		8.	If $f(x) = x^2 - x x = 10$, $\delta x = 0.1$ observe the		
	I: If $y = x^2 + 2x$, $x=3$, $\delta x = 0.01$ then dy=0	.08					
	II: If $y=x^2 + 2x$, $x=3$, $\delta x = 0.01$ then			I: $\delta f = 0.2301$			
	$\delta y = 0.082$			II: df=0.23			
	1. only I 2. only II			III: Relative error in x is	51		
	3. both I and II 4. neither I nor II			1. only I	2. only II,III		
3.	Which of the following statements are true			3. Only I,II	4. I,II,III		
	I: $\triangle ABC$ is insribed in a given circle then		9.	For a circle of diameter 5 cm error in diameter is 0.01 cm observe the following			
	$\delta a. \sec A + \delta b. \sec B + \delta c. \sec C = 1$			I: approximate error in	area is 0.25π sq.cm		
	II : Approximate value of $(1.0002)^{3000}$ is 0.6			II:relative error in area	$=0.04\pi$ sq.cm		
	1. only I 2. only II			III: percentage error in	area = 0.4π		
	3. both I and II 4. neither I nor II			1. only I	2. only II		
4.	Which of the following statements are true			3. only III	4. I,II,III		
	I: In $\triangle ABC$, b, c are fixed and error in			Observe the following s	tatements		
	A is δA then error is $a = \frac{2\Delta . \partial A}{a}$			I: If the radius of spheric	cal ball is increased by $\frac{1}{2}$ %		
	II. If cominantical angle of a consist of them a	mon		then approximate increa	ase in volume is 1%		
	in volume is base area times of error in	101		II: In measuring the radi	us and height of a cone as 0.02 cm 0.01 cm		
	1 only I 2 only II			respectively. Then error	in volume approximately		
	3. both Land II 4. niether Lnor II			is $2.25\pi c.c$			
5.	Which of the following statements are true			Corrcet statements is			
	I:Ratio of relative errors of y and x with resp	ect		1. only I	2. Only II		
	to given function $y = x^n$ is 1:n			3. both I and II	4. neither I nor II		
	II: If the error in base radius and height of c	one	11.	Observe the following	statements		
	are 1% then percentage error in volume is 3		List I		List II		
	1. only I 2. only II		I. If	$f(x) = x^2 + 2x,$	A) 1 : n		
	3. both I and II 4. neither I or II		x=	$\delta, \delta x = 0.1$ then df=			
6.	There is an error of 0.02cm is made in measure the radius 10cm of a circle. Then	ing	II. Ci	ircular plate is	B) 3		
	I:Approximate error in area is $0.5\pi sq.cm$		rd	jus 5cm to 5.06cm			
	II: Approximate percentage error in area is 0.	4	An	proximately increase			
	1. only I 2. only II		in	area is			
	3. both I and II 4. neither I or II		III. Si	ide of cube increasing	C)1.2		
7.	Semi vertical angle of a cone is 45° and heigh	ntis	by	1% then percentage			
	30.05 then which of the following are true		in	crease in volume is			
	I:Error in volume is 45π approximately		IV. F	Ratio of relative error in	D)n:1		
	1			$y = x^n$ is	E) 0.6π sq.cm		
	II: Percentage error in volume is $\frac{1}{2}$		-	The correct matching is	-		
	1. only I 2. only II			1. C,E,D,A	2. C,E,B,A		
	3. both I and II 4. neither I nor II			3. C,D,E,B	4. C,B,D,A		

12.	Match the percentage error of the following		16.	Observe the following and choose correct			
	and choose correct answer.			answer			
	I: For a cylinder percentage	A)8		A. Approximate value of $\tan 46^{\circ}$ is 1.0349 by			
	errors in r and h are 3 and 5 then percentage error in V is			taking $1^0 = 0.01745$ radians			
				$\mathbf{D} = \mathbf{f} \left(\mathbf{x} + \mathbf{S} \mathbf{x} \right)$			
				R: $f(x+\delta x)$ is approximately equal to			
				$f^{1}(x).\delta x + f(x)$			
	II:. $T = 2\pi \sqrt{\frac{1}{g}}$ percentage error in	B)11		1. A, R are true and R is correct expalantion of A .			
	T is 2 then percentage error in σ is	C)1		2. A,R are true and R is not correct explanation of			
	III:For a sphere percentage error	D)-1		$\begin{array}{c} \mathbf{A}, \\ 2, \mathbf{A} & \text{in form } \mathbf{D} & \text{in form } \mathbf{A} & \mathbf{A} & \text{in form } \mathbf{D} & \text{in form } \mathbf{A} \\ \end{array}$			
	1	2)1	17	3. A is true, K is faile 4. A is faile K is true			
	in r is $\frac{1}{3}$ then percentage error in		1/.	correct answer			
	volume is			A: In triangle ABC if a, A and R are fixed then			
		E)-4		$\delta a \operatorname{.secA+} \delta b \operatorname{.secB+} \delta c \operatorname{.secC=} 0$			
	Percentage error in volume is	,		R: In any triangle $A+B+C=\pi$ and so			
	1. A,D,C 2. C,E,B			$\delta A + \delta B + \delta C = 0$			
	3. B,E,C 4. B,D,C			1. A,R are true and R is correct expalantion of A.			
13.	If the side of a cube is 10 cm and e	rror in it is		2. A,R are true and R is not correct explanation of			
	0.05cm then match the following and			A. 2 A is true Disfolae A A is folge Distrue			
	Choose correct answer		10	5. A is true, K is faise 4. A is faise K is true			
I:Er	ror in surface area of cube	A)15	10.	correct answer			
	ercentage error in surface area	B) 6		Δ · If semi-vertical angle of a cone is $A = 0$ and height			
	for in volume	C)1.5		of the cone is 20.025 then approximate value of			
	ercentage error in volume	D)0.05 F)1		its volume is 10π sq.units			
	1 BDEA 2 ACED	L)1		R: If semi vertical angle of a cone is α and height			
	3. A.C.B.E 4. B.E.A.C			π 2 - 2			
14.	Radius of a sphere is 5 cm and error	in it is 0.1		is h then volume of cone is $\frac{1}{3} \tan^2 \alpha h^3$			
	then arrange the approximate val	ues of the		1.A is true R is false 2. A is false, R is true			
	following in ascending order and Choose correct answer			3. A, R are true and $R \Rightarrow A$			
	A:Error in volume			4.A,R are true $R \Longrightarrow A$			
	B. Percentage error in volume		19.	Observe the following statements and choose			
	C. Error in Area			correct answer.			
	D. Percentage error in Area			A: If semi vertical angle of a cone is 45° and height			
	1. C,A,D,B 2. D,B,C,A			is 20.025 then approximate value of its lateral			
	3. A,C,B,D 4. D,C,A,B			surface area is $401\sqrt{2}.\pi$			
15.	Radius of a circle in 2 cm and error in	it is $\frac{1}{10}$ cm		R: for a cone if semi vertical angle is α and height is h then lateral surface area of that cone is			
	then arrange the approximate val	ues of the		$\pi h^2 \cdot \tan \alpha \sec \alpha$			
	following in descending order and cho	oose correct		1. A is true R is false 2. A is false R is true			
	answer.			3. A,R are true and $R \Rightarrow A$			
	A. Error in diameter			4. A,R are true R is not equal to A.			
	C. Error in Area		20.	Observe the following statements and choose			
	U. Error in Area D. Palativa amor in mating			correct answer.			
	1 ABCD $2 DACR$			A: In a tangent galvanometer if error of 1% in			
	3. B,D,A,C 4. D,C,B,A			reading the deflection then error in current is $\frac{\pi}{2}$ %			
	· · · · · · · · · · · · · · · · · · ·			2^{70}			

	R: In tangent galvanometer experiment relative	tive KEY						
	error in current C is k. $\tan \theta$ (for some constant k)	1.3	2.1	3.4	4.3	5.2	6.2	
	1. A is false R is true	7.4	8.3	9.3	10.	3 11.2	2 12.3	
	2. A is false R is false	13.4	14.2	15.4	16.	1 17.	1 18.2	
	3. A , K are true $R \Rightarrow A$	19.3	20.4	21.1	22.	4 23.3	3 24.1	
	4. A is true, K is faise							
21.	A: Approximate value of $(1.0002)^{3000}$ is 1.6		PRE	VIOUS I	EAMC	CET QUE	STIONS	
	R: For the differentiable function						2005	
	$f(x+\delta x) \approx f(x) + f^{1}(x).\delta x$ where δx is change in x.	1.	When the radius of a circular plate is increasing at a rate of 0.01 cm/sec. The rate at which the area					
	The correct answer is		1s increas	ing when	the rac	$d_1us = 12c$	cm 1s	
	1. A,R are true and $R \Rightarrow A$		1.0.24 π	2.60	π	3.24 π	4. 1.2 π	
	2. A,R are true $R \neq A$						2002	
	3. A is true R is false	2.	The appro	oximate v	value of	f (1.0002)	\int_{0}^{3000} is	
	4. A is false R is true		1. 1.2	2.1.4		3. 1.6	4.1.8	
22.	: If the length (I) of the simple pendulum is $\frac{1}{2}$						1999	
	(T) is 2%	3.	In a cube.	The per-	centage	e increase.	. In the side is	
	R: If $y = x^n$ ratio of percentage errors in y and x is 1: n		1. The percentage increase in the volume of the cube is					
	1 Both A R are true and R is correct explanation		1.2	2.	1/2	3.3	4. 1/3	
	of A.						1998	
	2. Both A,R are true but R is not correct	4.	The value	e of (127)	$)^{1/3}$ to 4	decimal	places is	
	3 A false R is true		1. 5.0267	2.5.4	267	3. 5.5267	4. 5.0001	
	4. A is true R is false						1996	
23.	A: For a cone if r=6cm ,h=12cm and $\delta r = \delta h = 0.06cm$, then approximate error in	5.	The perce cube is 0.	entage er 5 percent	ror in 1 age err	measuring or in volu	g the side of a me is	
	volume in $36\pi c.c$		1. 1/2	2.1		3.3/2	4.2	
	R: Cone volume $v = \pi r^2 h$ and error	6.	The approximate percentage reduction in the volume of the cube of ice if each side is reduced					
	approximately is $dv = \pi . (2r . \delta r) . \delta h$		by 0.7% c	lue to me	lting is		4.2.2	
	1. A false, R is true		1. 2.1 2. 2.5 3. 3.2 4. 3.3					
	2. A is true, R is false	/.	If the length of simple. Pendulum decreases by 3% then the percentage error in the period T is					
	3. A,R are true and $R \Rightarrow A$ 4. A,R both false		1.2	2. 2	.5	3. 1.8	4. 1.5 1986	
24.	A: If semi vertical angle of a cone is 45° and height is 30.05 cm then approximate volume of cone is $9045.08 \pi c.c$	8.	If there is sphere wi error is its	s an erron hen its ra s surface	0.01 c adius is area =	cm in the s 5 cm. th	diameter of a ne percentage	
	R: When semi vertical angle is 45° approximate		1.0.2	2.0.6		3.0.5	4. $\pi/10$	
	error in volume is $dv = \pi r^2 \delta h$							
	1. A is false R is true			l	KEY			
	2. A is true R is false		2)2	3)3	<u>/</u>)1	5)4	6)1	
	3. A,R are true and $R \Rightarrow A$	$\begin{bmatrix} 1 \\ 1 \end{bmatrix}$	2J3 2\1	درد	4)1	5)4	0)1	
	4. A,R both false	/)3	0)1					

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ERRORS & APPROXMATION