21. ERRORS AND APPROXIMATIONS

1. Electric current is measured by tangent galvanometer, the current being proportional to the tangent of the angle θ of deflection. If the deflection is read as 45° and an error of 1% is made in reading it, then the percentage error in the current is **[AP EAMCET 17-09-20_Shift-1]**

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

2. If $y=5x^2+6x+6, x=2, \Delta x=0.001$ then the value of dy is **[AP EAMCET 17-09-20_Shift-1]**

1. 0.026
2. 0.0026
3. 0.062
4. 0.0062

3. If the radius of a sphere is mentioned as 7m with an error of 0.02 m then the approximate error in calculating its volume is **[AP EAMCET 18-09-20_Shift-2]**

1. $1.83\pi m^3$
2. $2.25\pi\ m^3$
3. $4.39\pi\ m^3$
4. $3.92\pi\ m^3$

4. What is an approximate value of $\sqrt{199}$ corrected to 4 decimal places? **[AP EAMCET 22-09-20_Shift-1]**

1. 14.1608
2. 14.0168
3. 14.1086
4. 14.1068

5. What is the value of $\sqrt[3]{26}$ corrected up to three decimal places? **[AP EAMCET 22-09-20_Shift-2]**

1. 2.998
2. 2.844
3. 2.962
4. 2.823

6. $(102)^4 = ?$ **[AP EAMCET 22-09-20_Shift-2]**

1. 108242316
2. 108423216
3. 102843216
4. 108243216

7. If the increase in the side of square is 6%, then the approximate percentage increase in its area____ **[AP EAMCET 22-09-20_Shift-2]**

1. 36%
2. 12%
3. 3%
4. 4%

8. If the semi vertical angle of a cone is 45^0 and its height is 20.025 cm,then the approximate value of its curved surface area (in sq.cm)is **[TS EAMCET 09-09-20_Shift-2]**

1. $401\pi\sqrt{2}$
2. $\frac{401\sqrt{2}}{\pi}$
3. $401\pi\sqrt{3}$
4. $(401.2)\pi$

9. The approximate value of $\left(\sqrt[3]{126}+\sin 61^0\right)$ correct to three decimal places, obtained by taking 10=0.0174 radians, is **[TS EAMCET 11-09-20_Shift-2]**

1. 5.772
2. 5.765
3. 5.806
4. 5.888

10. If the error committed in measuring the radius of a circle is 0.05%, then the corresponding error in calculating its area would be___ **[AP EAMCET 19-08-2021_Shift-1]**

1. 0.05%
2. 0.0025%
3. 0.25%
4. 0.1%

11. Given $f(x)=x^3-4x$. If 'x' chances from 2 to 1.99, then the approximate change in the value of $f(x)$ is___ **[AP EAMCET 19-08-2021_Shift-2]**

1. 0.08
2. -0.08
3. 0.8
4. -0.8

12. If the radius of a sphere is measured as 9 cm with an error of 0.03cm, then find the approximate error in calculating its surface area. **[AP EAMCET 20-08-2021_Shift-1]**

1. $2.16\pi\ cm^2$
2. $21.6\pi\ cm^2$
3. $216\pi\ cm^2$
4. $0.216\pi\ cm^2$

13. A spherical iron ball 10cm in radius is coated with a layer of ice of uniform thickness, which melts at a rate of $50cm^3/\min$. when the thickness of the ice is 15cm, the rate at which the thickness of ice decreases is ____ cm/min **[AP EAMCET 20-08-2021_Shift-2]**

1. $\frac{5}{6\pi}$
2. $\frac{1}{54\pi}$
3. $\frac{1}{18\pi}$
4. $\frac{1}{36\pi}$

14. The time period 'T' of a simple pendulum of length 'l' is given by $T = 2\pi\sqrt{\frac{l}{g}}$ where 'g' denotes the acceleration due to gravity. If the length of the pendulum is increased by 1%, then the approximate change in its time period is ___ **[AP EAMCET 23-08-2021_Shift-1]**

1. 0.5%
2. 2%
3. 1%
4. 4%

15. If $y = 5x^2 + 6x + 6, x = 2$ and $\Delta x = 0.001$, then the values of Δy and dy respectively are:

[AP EAMCET 25-08-2021_Shift-2]

1. 0.026 & 0.026005
2. 0.026005 & 0.026
3. 0.026005 & 0.26
4. 0.0026 & 0.026

16. The approximate value of $(8.01)^{\frac{4}{3}} + (8.01)^2$ upto 3 decimal place is

[TS EAMCET 04-08-2021_Shift-1]

1. 80.116
2. 80.216
3. 80
4. 80.186

17. The side of an equilateral triangle is 5 units. In measuring the side, an error of 0.05 units is made. Then the percentage error in measuring the area of the triangle is

[TS EAMCET 06-08-2021_Shift-2]

1. 2
2. 3
3. 4
4. 5

18. The semi vertical angle of a right circular cone is 30^0. If the height of the cone is 6.125 cm, then the approximate value of the cone (in cubic cm) is **[TS EAMCET 06-08-2021_Shift-1]**

1. $(23.5)\pi$
2. $(76.5)\pi$
3. 48π
4. $(25.5)\pi$

19. If an error of 0.02 sq.cm is found in the surface area of a sphere when its radius is measured as 10 cm. then the approximate error that occurs in the volume of the sphere. in cubiccentimetres. Is

[TS EAMCET 18-07-2022_Shift-2]

1. 0.2
2. 0.01
3. 0.3
4. 0.1

20. The approximate value of $\sqrt[3]{28}$ rounded up to 3 decimal places is

[TS EAMCET 20-07-2022_Shift-1]

1. 3.012
2. 3.037
3. 3.025
4. 3.033

21. Electric current (I) is measured by galvanometer, the current being proportional to the tangent of the angle (θ) of deflection. If the deflection is read as 45^o and an error of 1% is made in reading it, the percentage error in the current is **[12TH MAY 2023 SHIFT -2]**

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

22. The nearest approximate value of $\sqrt{2023}$ is

1. $(6.6)^2$
2. 44.9778
3. $(6.8)^2$
4. 44.7777

23. The diameter of a sphere is measured as 42 cm. If there is an error of 1/77 cm in measuring it, then the error involved in the volume of that sphere (in cubic centimeters) is **[EAPCET 13-05-23 SHIFT-2]**

1. 33
2. 24/7
3. 36
4. 36/7

KEY

1)	2	**2)**	1	**3)**	4	**4)**	4	**5)**	3
6)	4	**7)**	2	**8)**	1	**9)**	4	**10)**	4
11)	2	**12)**	1	**13)**	3	**14)**	1	**15)**	2
16)	2	**17)**	1	**18)**	4	**19)**	4	**20)**	2
21)	2	**22)**	2	**23)**	3				

SOLUTIONS

1. $c \propto \tan\theta \Rightarrow c = k\tan\theta$

Given that $\frac{\delta\theta}{\theta} \times 100 = 1$

$\Rightarrow \delta\theta = \frac{\theta}{100}$

$\frac{\delta c}{c} \times 100 = 2 \times \frac{\pi}{4} \times \frac{1}{100} \times 100 = \frac{\pi}{2}$

2. $dy = f'(x)\Delta x = (10x+6)\Delta x$

$= 26(0.001)$

$= 0.026$

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

$\Rightarrow \delta V = 4\pi r^2 \delta r = 3.92\pi$

4. $\sqrt{199} = 14.1068$

5. $(27-1)^{\frac{1}{3}} \quad x = 27, \delta x = -1$

$f(x) = x^{\frac{1}{3}}$

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

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

$= \frac{-1}{27} + 3$

$(26)^{\frac{1}{3}} \cong 3 - 0.037 = 2.963$

6. $(102)^2 = 10404$

$(102)^4 = 102^2 \times 102^2$

$= 10404 \times 10404 = 108243216$

7. *Given* $\frac{\delta x}{x} \times 100 = 6$

Area of a square $A = x^2$

$\log A = 2\log x$

$\frac{\delta A}{A} \times 100 = 2\frac{\delta x}{x} \times 100$

Approx. percentage increase in its area $= 12\%$

8. $\theta = 45^0$, r=h, h=20cm, $\delta h = 0.025cm$

Curved surface area of cone $S = \pi rl$

$l^2 = r^2 + h^2, l = \sqrt{2}h$

$S = \sqrt{2}\pi h^2 = 400\sqrt{2}\pi \Rightarrow \delta S = \sqrt{2}\pi$

Approximate value $= 401\sqrt{2}\pi$

9. $f(x) = \sqrt[3]{x}, x = 125, \delta x = 1$

$f(x+\Delta x) = f(x) + f'(x).\Delta x = x^{\frac{1}{3}} + \frac{1}{3}.x^{\frac{-2}{3}}$

$f(x+\Delta x) = 5 + \frac{1}{3}.\frac{1}{125^{\frac{2}{3}}} = 5.01$

Let

$g(x) = \sin x, x = 60^0, \Delta x = 1^0$

$g(x+\Delta x) = g(x) + g'(x).\Delta x$

$= \sin x + \cos x.\Delta x$

$= \frac{\sqrt{3}}{2} + \frac{1}{2}(0.0174) = 0.86$

Approximate value of $\sqrt[3]{126} + \sin 61^0 = 5.87$

10. $\frac{\delta A}{A} \times 100 = 2\left[\frac{\delta r}{r} \times 100\right] = 2 \times 0.05 = 0.1\%$

11. $\Delta.f(x) = (3x^2 - 4).\Delta x =$

$\left[3(2)^2 - 4\right](-0.01) = -0.08$

12. $A = 4\pi r^2 \Rightarrow \delta A = 8\pi r.\delta r$

$= 8\pi(9)(0.03) = 2.16\pi cm^2$

13. $r = 10, R = 10 + h, \frac{dv}{dt} = -50.$

$V = \frac{4}{3}\pi\left(R^3 - r^3\right)$

$\Rightarrow V = \frac{4}{3}\pi\left[(10+h)^3 - 10^3\right]$

$\Rightarrow \frac{dv}{dt} = 4\pi(10+h)^2.\frac{dh}{dt}$

$\Rightarrow -50 = 4\pi(10+5)^2\frac{dh}{dt}$

$\Rightarrow \frac{dh}{dt} = -\frac{1}{18\pi} cm/\min.$

14. $\frac{\delta T}{T} \times 100 = \frac{1}{2}\left[\frac{\delta l}{l} \times 100\right] = \frac{1}{2} \times 1 = 0.5\%$

15. $\Delta y = f(x+\Delta x) - f(x) = 0.026005$

$dy \simeq f'(x).\Delta x = 0.026.$

16. $(8.01)^{\frac{4}{3}} + (8.01)^2$

$\Rightarrow (8.01)(8.01)^{\frac{1}{3}} + (8.01)^2$

$\Rightarrow (8.01)\left[(8.01)^{1/3} + 8.01\right].....(1)$

Approximate value of $(8.01)^{1/3}$

$f(x)=x^{1/3}, x=8, \delta x=0.01$

$f(x+\delta x)=f(x)+f'(x)\delta x$

$$=x^{1/3}+\frac{1}{3}x^{\frac{-2}{3}}\delta x$$

$$=2+\frac{1}{3}\cdot\frac{9}{4}(0.01)$$

$$\equiv 2.00083$$

Sub (1) we get approximate value $=80.1867$

17. $\Delta x=0.05, \frac{\Delta A}{A}\times 100=$ ____?

$A=\sqrt{s(s-a)(s-b)(s-c)}$

Perimeter $2S=15x \Rightarrow S=\frac{15x}{2}$

$A=\frac{25}{4}\sqrt{3}x^2$

$\Delta A=\frac{25\sqrt{3}}{4}.2x\Delta x, A=\frac{25\sqrt{3}}{4}x^2$

$\frac{\Delta A}{A}\times 100=\frac{2\Delta x}{x}\times 100=2$

18. Volume of cone $(V)=\frac{1}{3}\pi r^2 h$

w.k.t $\text{Tan}\theta=\frac{r}{h}\Rightarrow \tan 30^0=\frac{r}{6.125}$

$r=\frac{6.125}{\sqrt{3}}$

Volume of the cone $=\frac{1}{3}\pi r^2 h$

$\Delta V=\frac{1}{3}\times\pi\times\frac{(6.125)^2}{3}\times 6.125=(25.53)\pi$

19. $\delta S=0.02$ sq.cm, r = 10cm

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

20. $f(x)=3\sqrt{x}$

$x=27, \delta x=1$

$f(x+\delta x)=f(x)+f'(x)\delta x$

21. $i \alpha \tan\theta$

$i=k\tan\theta$

$\log i=\log k+\log\tan\theta$

$\frac{1}{i}\Delta i=2\frac{\Delta\theta}{\theta}\times 100\times\theta$

$\frac{\Delta i}{i}\times 100=\cancel{2}\times 1\times\frac{\pi}{\cancel{2}}$

$=\frac{\pi}{2}$

22. $f(x)=\sqrt{x}, x=2025, \Delta x=-2$

$f(x+\Delta x)=f(x)+f'(x)\Delta x$

$=\sqrt{x}+\frac{1}{2\sqrt{x}}(-2)$

$=\sqrt{2025}+\frac{1}{2\sqrt{2025}}(-2)$

$=45-\frac{1}{45}=\frac{2024}{45}=44.9778$

23. $d=42,\ \Delta d=\frac{1}{77}$

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

$V=\frac{4\pi}{3}\left(\frac{d}{2}\right)^3=\frac{\pi}{6}d^3$

$\Delta V=\frac{\pi}{2}d^2\Delta d$

$=\frac{\cancel{22}\ ^{1}}{\cancel{7}}\times\frac{1}{\cancel{2}}\times\cancel{42}_{6}\times\cancel{42}_{6}\times\frac{1}{\cancel{77}\ _{1}}=36$