

# MAHESH TUTORIALS SCIENCE

|         |  |                              |                      |
|---------|--|------------------------------|----------------------|
| 00 – 00 |  | Q. Booklet Serial No: 070615 |                      |
| 3 Hrs.  |  |                              | Q. Booklet Version : |

## Hints & Solutions

| PART A - PHYSICS   |   |  |
|--|---|--|
| <p>1. <b>b) 4</b><br/>A zero is significant if it comes after decimal point</p> <p>2. <b>c) 2</b><br/>Leading zeros are never significant so only 2.</p> <p>3. <b>a) 4</b><br/>Zero is significant if it comes after decimal point</p> <p>4. <b>b) 36.4</b><br/>Answer must have least no. of decimal place digits of given no.</p> <p>5. <b>c) 38.282</b><br/>Answer must have least no. of decimal place digits of given no.</p> <p>6. <b>d) 66.8</b><br/>in multiplication Answer must have least no. of significant digits that of input numbers.</p> <p>7. <b>b) 2.3 kg</b><br/>In addition we check minimum no. of significant digits after decimal.<br/>so 2.31 kg → 2.3 kg.</p> <p>8. <b>b) 12.6</b><br/>There is 6 before 5 that is even so 5 will change in 6. Thats 12.6</p> <p>9. <b>c) 6.8</b><br/>There is '8' after 7 so we will make 7 → 8 so answer will be 6.8</p> | <p>10. <b>a) 16.4</b><br/>There is odd no before 5 so we will increase it by 1 so 16.4</p> <p>11. <b>b) 3</b><br/>In exponential notation, the numerical portion gives the no. of signification. so 1.32 ⇒ 3 digits</p> <p>12. <b>d) 0.0101</b><br/>Leading zero are never significant</p> <p>13. <b>b) 1.234</b><br/>Only (B) has four significant digits</p> <p>14. <b>a) 1</b><br/>Leading zero doesn't Count as significant</p> <p>15. <b>d) 3 cos x</b><br/><math display="block">\frac{d}{dx} (3 \sin x + 4) = 3 \frac{d}{dx} \sin x + \frac{d}{dx} 4</math><math display="block">= 3 \cos x + 0</math></p> <p>16. <b>b) x<sup>2</sup> + x + 1</b><br/><math display="block">\frac{d}{dx} \left( \frac{x^3}{3} + \frac{x^2}{2} + x + 2 \right) = x^2 + x + 1</math></p> <p>17. <b>c) 3sec<sup>2</sup>x</b><br/><math display="block">3 \frac{d}{dx} \tan x = 3 \sec^2 x</math></p> <p>18. <b>b) x(1 + 2 ln x)</b><br/>apply uv rule<br/><math display="block">\frac{d}{dx} (x^2 \ln x) = x^2 \frac{d}{dx} \ln x + \ln x \left( \frac{d}{dx} x^2 \right)</math><math display="block">= \frac{x^2}{x} + 2x \ln x</math></p> |  |

$$= x(1 + 2 \ln x)$$

19. a)  $\frac{x(2 \ln x - 1)}{(\ln x)^2}$

$$\frac{d}{dx} \left( \frac{x^2}{\ln x} \right) = \frac{(\ln x) \frac{d}{dx} x^2 - x^2 \frac{d}{dx} \ln x}{(\ln x)^2}$$

$$= \frac{2x \ln x - x}{(\ln x)^2}$$

20. c) **3 cos x + 2 sin x**

$$3 \frac{d}{dx} \sin x - 2 \frac{d}{dx} \cos x = 3 \cos x + 2 \sin x$$

21. a) **sec x (tan x + sec x)**

$$\frac{d}{dx} (\tan x) + \frac{d}{dx} \sec x$$

$$= \sec^2 x + \sec x \cdot \tan x$$

$$= \sec x (\sec x + \tan x)$$

22. b) **ln x + 1**

$$\frac{d}{dx} x \ln x = \ln x \frac{dx}{dx} + x \frac{dx}{dx} \ln x = \ln x + 1$$

23. c)  $-\frac{2}{x^3} - \frac{3}{x^4}$

$$\frac{d}{dx} \left( \frac{1}{x^2} \right) + \frac{dx}{dx} \left( \frac{1}{x^3} \right) = -\frac{2}{x^3} - \frac{3}{x^4}$$

24. d)  $\frac{1}{2\sqrt{x}}$

$$\frac{d}{dx} x^{\frac{1}{2}} = \frac{1}{2} x^{\frac{1}{2}-1} = \frac{1}{2\sqrt{x}}$$

25. b)  $-\frac{2}{(x-1)^2}$

$$\frac{d}{dx} \left( \frac{x+1}{x-1} \right) = \frac{(x-1) - (x+1)}{(x-1)^2} = -\frac{2}{(x-1)^2}$$

26. b)  $1 - \frac{1}{x^2}$

$$f'(x) = \frac{d}{dx} x + \frac{d}{dx} \left( \frac{1}{x} \right) = 1 - \frac{1}{x^2}$$

27. a) **7**

$$\frac{d}{dx} (2x^2 + 3x + 2) = 4x + 3 \text{ slope at } x = 1$$

$$= 4 + 3 = 7$$

28. a) **2 sin x + cos x (3 + 2x)**

$$3 \frac{d}{dx} \sin x + 2 \frac{d}{dx} x \sin x$$

$$= 3 \cos x + 2x \cos x + 2 \sin x$$

$$= \cos x (3 + 2x) + 2 \sin x$$

29. b)  $\frac{1}{2} \left( \frac{1}{\sqrt{x}} + 3\sqrt{x} \right)$

$$\frac{d}{dx} \sqrt{x} + \frac{d}{dx} x \sqrt{x} = \frac{1}{2} x^{\frac{1}{2}-1} + \frac{3}{2} x^{\frac{3}{2}-1}$$

$$= \frac{1}{2\sqrt{x}} + \frac{3\sqrt{x}}{2}$$

30. c)  $-\frac{2x}{(x^2+1)^2}$

$$F(x) = \frac{1}{x^2+1} \Rightarrow f'(x) = \frac{-2x}{(x^2+1)^2}$$

31. b)  $\frac{1}{(x+1)^2}$

$$\frac{d}{dx} \left( \frac{x}{x+1} \right) = \frac{d}{dx} \left( 1 + \frac{-1}{x+1} \right) = \frac{1}{(x+1)^2}$$

32. c) **7 ± 0.5**  
error addition

33. b) **3 ± 0.6**  
error is always maximum so 3 ± 0.6

34. b) **2.4 m**

$$x_{\text{mean}} = \frac{2.3 + 2.4 + 2.5}{3} = 2.4 \text{ M}$$

35. **a)  $19 \pm 1.5 \text{ cm}^2$**   
 $A = l \times b = 5.7 \times 3.4 = 19.38 \text{ cm}^2$   
 $= 19.0 \text{ cm}^2$  (Rounding off)  
 $\frac{\Delta A}{A} = \pm \left( \frac{\Delta l}{l} + \frac{\Delta b}{b} \right)$   
 $\Delta A = \pm 1.48 \text{ cm}^2 = \pm 1.5 \text{ cm}^2$
36. **c) 6%**  
 $V = a^3$   
 $\frac{dV}{V} \times 100 = 3 \left( \frac{\Delta a}{a} \times 100 \right)$   
 $= 3 \times 2 = 6\%$
37. **d) 6%**  
 $\frac{\Delta Q}{Q} \times 100 = 2 \frac{\Delta I}{I} \times 100 + \frac{\Delta R}{R} \times 100 + \frac{\Delta t}{t} \times 100$   
 $= 2 \times 2 + 1 + 1$   
 $= 6\%$
38. **d) 9.5%**  
 $\frac{\Delta x}{x} \times 100 = \frac{\Delta a}{a} \times 100 + 2 \left( \frac{\Delta b}{b} \times 100 \right) + \frac{1}{2} \frac{\Delta c}{c} \times 100$   
 $= 4 + (2 \times 2) + \frac{1}{2} \times 3$   
 $= 9.5\%$
39. **b)  $\frac{b}{a}$**   
fractional error is  $\frac{\Delta x}{x} = \frac{b}{a}$
40. **c)  $6 \pm 0.7$**   
Let  $x = pq = x_0 \pm \Delta x$   
 $x_0 = 3 \times 2 = 6$   
 $\frac{\Delta x}{x_0} = \frac{\Delta P}{P} + \frac{\Delta Q}{Q}$   
 $\Delta x = 0.3 + (0.2) \times 2 = 0.7$   
so  $6 \pm 0.7$
41. **b) 3.0**  
In division Answer must have least no. of significant digits that of Inputs.
42. **b) 4%**  
 $\frac{\Delta F}{F} \times 100 = 2 \frac{\Delta R}{R} \times 100 = 2 \times 2 = 4\%$
43. **a)  $\frac{x \cos x - \sin x}{x^2}$**   
 $\frac{d}{dx} \left( \frac{\sin x}{x} \right) = \frac{x \cos x - \sin x}{x^2}$
44. **a)  $e^x (x + 1)$**   
 $\frac{d}{dx} x e^x = x e^x + e^x \frac{d}{dx} x$   
 $= e^x (x + 1)$
45. **a) 0.01**  
 $av = \frac{3.38 + 3.40 + 3.45}{3} = 3.41$   
so  $\Delta x = |3.41 - 3.40| = 0.01$