MATHS

BOOKS - S CHAND MATHS (ENGLISH)

DIFFERENTIATION

Example

1. Differentiate the following functions with respect to x from definition.

(i) x^2

2. Differentiate $\sqrt{x}$ with respect to x from definition.

3. Differentiate $\dfrac{1}{x^3}$ with respect to x from definition.

4. Differentiate $\sqrt{ax + b}$ with respect to x from definition.

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5. Differentiate $\dfrac{ax + b}{ax + d}$ with respect to x from definition.

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6. Using first principles, prove that

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

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7. Let $y = ax^3 + bx^2 + cx + d$. Find the rate of change of y w.r.t x at x=0.

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8. Let $y = x + \dfrac{1}{x}$.Find the rate of change of y

w.r.t. x at x=2.

9. Find the roots of quadrratic equation

$x^2 - 3x + 2.$

10. Let $y = x^{\frac{2}{3}} + 2x^2$. Find the instantaneous rate of change of y with respect to x at x = 1.

11. Let $y = \dfrac{x + 3}{x}$. Find the instantaneous rate of change of y with respect to x at x = 3.

12. Let $y = \left(x + \dfrac{1}{x}\right)^2$ Find the rate of change of y with respect to x when x=2.

13. The equation of a tangent to the parabola $y^2 = 8x$ is $y = x + 2$. The point on this line from which the other tangent to the parabola is perpendicular to the given tangent is (1) $(-1, 1)$ (2) $(0, 2)$ (3) $(2, 4)$ (4) $(-2, 0)$

14. (i) Find the differentiation of $y = (x^2 - 4x + 5)(x^3 - 2)$

15. (ii) Differentiate $y = x^3\sqrt{3x - 4}$

16. (iii) Let $y = (x + 1)(2x + 3)^3(5x + 7)^2$

17. (i) Let $y = \dfrac{(2 + 5x)^2}{x^3 - 1}$ then find dy/dx

18. (ii) Let $y = \dfrac{x}{a^2 + x^2}$ then find dy/dx

19. Differentiate w.r.t.x Let $y = \dfrac{ax^2 + bx + c}{px^2 + qx + f}$

20. (iv) Let $y = \dfrac{1}{ax^2 + bx + c}$ then find dy/dx

21. (v) Let $y = \sqrt{\dfrac{1 + x}{1 - x}}$ find dy/dx

22. The equation of a tangent to the parabola $y^2 = 8x$ is $y = x + 2$. The point on this line from which the other tangent to the parabola is perpendicular to the given tangent is (1) $(- 1, 1)$ (2) $(0, 2)$ (3) $(2, 4)$ (4) $(- 2, 0)$

Exercise 19 A

1. Differentiate from first principles:

1. $2x$

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2. Differentiate from first principles:

2. $(x - 1)^2$

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3. Differentiate from first principles:

3. x^3

4. Differentiate from first principles:

4. $\dfrac{1}{\sqrt{x}}$

5. Differentiate from first principles:

5. $\sqrt{x+1},\ x > -1$

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6. Differentiate from first principles:

6. $\dfrac{2x+3}{3x+2}$

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7. Differentiate from first principles:

7. $\dfrac{1}{\sqrt{x+1}}$

8. Differentiate from first principles:

8. $x + \dfrac{1}{x}$

9. Differentiate from first principles:

9. $\sqrt{2x + 3}$

10. Differentiate from first principles:

10. $\dfrac{1}{x^{\frac{3}{2}}}$

11. Differentiate from first principles:

11. $(x + 1)(2x - 3)$

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12. Differentiate from first principles:

12. $\dfrac{x^2 + 1}{x}$

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Exercise 19 B

1. Differentiate the following functions:

$$(ax)^m + b^m$$

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2. Differentiate the following functions:

$$x^3 + 4x^2 + 7x + 2$$

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3. Differentiate the following functions:

$$7x^6 + 8x^5 - 3x^4 + 11x^2 + 6x + 7$$

4. Differentiate the following functions:

$$3 + 4x - 7x^2 - \sqrt{2}x^3 + \pi x^4 - \frac{2}{5}x^5 + \frac{4}{3}$$

5. Differentiate the following functions:

$$\frac{3}{x^5}$$

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6. Differentiate the following functions:

$$x^{\frac{5}{3}}$$

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7. Differentiate the following functions:

$$\frac{7}{x^{\frac{2}{3}}}$$

8. Differentiate the following functions:

$$\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2, \; x \neq 0$$

9. Differentiate the following functions:

$$\sqrt{x} - \frac{1}{\sqrt{x}}, \; x \neq 0$$

10. Differentiate the following functions:

10. $\dfrac{1}{x} + \dfrac{3}{x^2} + \dfrac{2}{x^3}$

11. Differentiate the following functions:

11. $2x^{\frac{1}{2}} + 6x^{\frac{1}{3}} - 2x^{\frac{3}{2}}$

12. Differentiate the following functions:

12. $8x^3 - x^2 + 5 - \dfrac{2}{x} + \dfrac{4}{x^3}$.

13. Differentiate the following functions:

13. $\dfrac{3x^7 + x^5 - 2x^4 + x - 3}{x^4}$

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14. Differentiate the following functions:

14. (i) $(2x - 3)^2$ (ii) $(2x - 3)^{100}$

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15. Differentiate the following functions:

15. $\sqrt{3x + 2}.$

16. Differentiate the following functions:

Given $f(x) = \dfrac{7}{4}x^2$, find $f'\left(\dfrac{1}{7}\right)$

17. Find the derivative with respect to x of the following:

(i) $x - \dfrac{1}{x}$

18. Find the derivative with respect to x of the following:

(ii) $\sqrt{x} + \dfrac{1}{\sqrt{x}}$

19. Find the derivative with respect to x of the following:

(iii) $3x^2 + \dfrac{3}{x^2}$

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20. Find the derivative with respect to x of the following:

(iv) $\dfrac{x^2 + 1}{x}$

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21. Find the derivative with respect to x of the following:

$$\frac{2x + x^4}{x^2}$$

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22. Find the derivative with respect to x of the following:

$$\frac{1 + x^2}{x^3}$$

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23. If $y = x + \dfrac{1}{x}$, prove that $x^2 \dfrac{dy}{dx} - xy + 2 = 0$

24. If $y = \sqrt{x} + \dfrac{1}{\sqrt{x}}$, prove that $2x \dfrac{dy}{dx} + y = 2\sqrt{x}$.

25. If $y = \dfrac{1}{a - z}$, show that $\dfrac{dz}{dy} = (z - a)^2$

26. If $y = 1 + x + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \dfrac{x^4}{4!} + \ldots$ to ∞, show that $\dfrac{dy}{dx} = y$.

Exercise 19 C

1. Differentiate the following w.r.t. x or t or u as the case may be:

1. $(ax + b)(cx + d)$

2. Differentiate the following w.r.t. x or t or u as

the case may be:

2. $\left(x^{100} + 2x^{50} - 3\right)\left(7x^8 + 20x + 5\right)$

3. Differentiate the following w.r.t. x :

$3x(2x - 1)(x + 2)$

4. Differentiate the following w.r.t. x :

$$(x - 2)(x + 3)(2x + 5)$$

5. Differentiate the following w.r.t. x or t or u as the case may be:

5. $y = \dfrac{2x + 5}{3x - 2}$

6. Differentiate the following w.r.t. x :

$$y = \frac{x^2 - 3}{x + 4}$$

7. Differentiate the following w.r.t. x or t or u as

the case may be:

7. $y = \dfrac{2x - 3}{3x + 4}$

8. Differentiate the following w.r.t. x or t or u as the case may be:

$$y = \frac{x^5 - x + 2}{x^3 + 7}$$

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9. Differentiate the following w.r.t. x or t or u as the case may be:

$$s = t^2(t + 1)^{-1}$$

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10. Differentiate the following w.r.t. x or t or u as the case may be:

10. $z = \dfrac{u}{u^2 + 1}$

11. Differentiate the following w.r.t. x or t or u as the case may be:

11. $y = \dfrac{x^2 + 2x + 5}{x^3 + 2x + 4}$

12. Differentiate the following w.r.t. x or t or u as the case may be:

12. $f(x) = \dfrac{x^3 + 2x}{x^2 + 4}$

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13. If $f(x) = \dfrac{x + 2}{x - 2}$ for all $x \neq 2$, find $f'(-2)$.

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14. Differentiate $\dfrac{x + 2}{x^2 - 3}$ and find the value of the derivative at $x = 0$.

15. If $y = \dfrac{x}{x + a}$, prove that $x\dfrac{dy}{dx} = y(1 - y)$.

16. If $x\sqrt{1 + y} + y\sqrt{1 + x} = 0$, prove that $\dfrac{dy}{dx} = -\dfrac{1}{(1 + x)^2}$.

17. Given that $y = \sqrt{\dfrac{1-x}{1+x}}$ show that $\left(1 - x^2\right)\dfrac{dy}{dx} + y = 0$

18. Given that $y = (3x - 1)^2 + (2x - 1)^3$, find $\dfrac{dy}{dx}$ and the points on the curve for which $\dfrac{dy}{dx} = 0$

19. (i) If $y = \dfrac{x - 1}{2x^2 - 7x + 5}$, find $\dfrac{dy}{dx}$ at $x = 2$.

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20. If $y = \dfrac{x^2 + 3}{x^3 + 2x}$, find $\dfrac{dy}{dx}$ at $x = 1$.

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21. Find the co-ordinates of the points on the curve $y = \dfrac{x}{1 - x^2}$ for which $\dfrac{dy}{dx} = 1$

Exercise 19 D

1. Differentiate the following functions w.r.t. x:

$\sin 5x$

2. Differentiate the following functions w.r.t. x:

$\cos 8x$

3. Differentiate the following functions w.r.t. x:

$\sin(5x + 9)$

4. Differentiate the following functions w.r.t. x:

$\cos(2x - 3)$

5. Differentiate the following functions w.r.t. x:

$\tan 7x$

6. Differentiate the following function w.r.t. x:

$\cot nx$

7. Differentiate the following functions w.r.t. x:

$\tan(6x + 11)$

8. Differentiate the following functions w.r.t. x:

$$\frac{\sin x}{3}$$

9. Differentiate the following functions w.r.t. x:

$$\sec mx$$

10. Differentiate the following functions w.r.t. x:

$$\sec\left(\frac{x}{2} - 1\right)$$

11. Differentiate the following functions w.r.t. x:

$$\cos ec\frac{2}{3}x$$

12. Differentiate the following functions w.r.t. x:

$x \sin x$

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13. Differentiate the following function w.r.t. x:

$x^2 \cos 5x$

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14. Differentiate the following function w.r.t. x:

$$\sqrt{x}\cos ec(5x + 7)$$

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15. Differentiate the following functions w.r.t. x:

$$\frac{\sin 3x}{x - 6}$$

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16. Differentiate the following functions w.r.t. x:

$$\frac{\cos x}{5x}$$

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17. Differentiate the following functions w.r.t. x:

$$\frac{\tan x}{2x + 3}$$

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18. Differentiate the following functions w.r.t. x:

$$\frac{\sec(ax - b)}{x^2 - 2}$$

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19. Differentiate the following functions w.r.t. x:

$$\sin 2x$$

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20. Differentiate the following functions w.r.t. x:

$\cos 3x$

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21. Differentiate the following functions w.r.t. x:

$\tan 2x$

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22. Differentiate the following functions w.r.t. x:

$$\sin \frac{x}{2}$$

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23. Differentiate the following functions w.r.t. x:

$$\sec ax$$

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24. Differentiate the following functions w.r.t.

x:

$$\sec(px + q)$$

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25. Differentiate the following functions w.r.t.

x:

$$\tan(4x - 7)$$

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1. Find from first principles the differential coefficient of $2x^2 + 3x$.

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2. Find from first principles the differential coefficient of $\sin 2x$.

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3. Differentiate the following function w.r.t. x.

$$f(x) = \sqrt{3x + 4}, \, x > -1$$

4. Differentiate the following functions w.r.t. x.

$$f(x) = \sqrt{4 - x}, \, x < 4$$

5. Differentiate the following functions w.r.t. x.

$$f(x) = \frac{3x + 4}{4x + 3}\left(x \neq \frac{-3}{4}\right)$$

6. Differentiate the following functions w.r.t. x.

$$f(x) = \sqrt{x^2 + 1}$$

7. Differentiate the following functions w.r.t. x.

$$(2x + 3)(x^3 - x + 2)$$

8. Differentiate the following function w.r.t. x.

$\tan(5x + 7)$

9. Differentiate the following functions w.r.t. x.

$\sin^2(3x - 2)$

10. Differentiate the following functions w.r.t. x.

$$\left(x^3 + \sin x\right)^5$$

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