

Question Bank- Shawnm Mudhafer Saleh- Mathematics I

Differentiate:

1. $r = \frac{12}{\theta} - \frac{4}{\theta^3} + \frac{1}{\theta^4}$

2. $w = (2x - 7)^{-1}(x + 5)$

3. $y = \frac{x^5}{120}$

4. $y = x^2 + x + 8$

5. $y = -10x + 3 \cos x$

6. $y = (\sec x + \tan x)(\sec x - \tan x)$

7. $y = x^2 \sin x + 2x \cos x - 2 \cos x$

8. Find y'''' for $y = 9 \cos x$

9. Find dy/dx by using chain rule

i. $y = \sec(\tan x)$

ii. $y = \cot\left(\pi - \frac{1}{x}\right)$

Integrate:

10. $\int 28(7x - 2)^{-5} dx$

11. $\int \sqrt{x} \sin^2\left(x^{\frac{3}{2}} - 1\right) dx$

12. $\int \csc^2 2\theta \cot 2\theta d\theta$

13. $\int \frac{(1+\sqrt{x})^3}{\sqrt{x}} dx$

14. $\int x^3 \sqrt{x^2 + 1}$

15. $\int_0^{-2} \sqrt{2} dx$

16. $\int_3^5 \frac{x}{8} dx$

$$17. \int_1^0 (3x^2 + x - 5) dx$$

- Evaluate integrals:

$$18. \int_2^1 \left(1 + \frac{z}{2}\right) dz$$

$$19. \int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \csc \theta \cot \theta d\theta$$

$$20. \int_{-\sqrt{3}}^{\sqrt{3}} (t + 1)(t^2 + 4) dt$$

$$21. \int \frac{1}{t^2} \cos\left(\frac{1}{t} - 1\right) dt$$

$$22. \int \frac{1}{\theta^2} \sin \frac{1}{\theta} \cos \frac{1}{\theta} d\theta$$

$$23. \int r^4 \left(7 - \frac{r^5}{10}\right)^3 dr$$

$$24. \int \sin(8z - 5) dz$$

$$25. \int \sec 2t \tan 2t dt$$

$$26. \text{ Find the area enclosed by the } x + y^2 = 0 \text{ and } x + 3y^2 = 2$$

Differentiate the following functions

$$27. y = \frac{1}{2} x^2 \csc \frac{2}{x}$$

$$28. x^3 + 4xy - 3y^{\frac{4}{3}} = 2x$$

$$29. y^2 \cos\left(\frac{1}{y}\right) = 2x + 2y$$

$$30. \text{ Differentiate this function by using chain rule } y = \left(\frac{x}{5} + \frac{1}{5x}\right)^5$$

31. At time t , the position of a body moving along the s -axis is

$$s = t^3 - t^2 + 9t$$

- Find the body's acceleration each time the velocity is zero.
- Find the body's speed each time the acceleration is zero.

$$32. \text{ Graph } f(x) = 2x^4 - 4x^2 + 1$$

Comment on the behavior of f in relation to the signs and values of f' and f''

33. $g(x) = \left(\frac{1+\cos t}{\sin t}\right)^{-1}$

34. $r = (\csc \theta + \cot \theta)^{-1}$

35. $y = \sqrt{1 + \cos(t^2)}$

36. Find the slope of the curve at the given points

$$y^2 + x^2 = y^4 - 2x \quad \text{at } (-2,1) \text{ and } (-2,-1)$$

37. Differentiate:

$$x^2 \cos^2 y - \sin y = 0$$

38. Find Extreme values:

$$y = \frac{x}{x^2+1} \quad -1 < x < 3$$

39. Sketch a graph for this function

$$y = 1 - 9x - 6x^2 - x^3$$

40. Sketch a graph of the function

$$y = 2x - 3x^{2/3}$$

41. Example a draining hemispherical reservoir

Water is flowing at the rate of $6 \text{ m}^3/\text{min}$ from a reservoir shaped like a hemispherical bowl of radius 13 m. Answer the following questions, give that the volume of water in a hemispherical bowl of radius R is

$$V = \left(\frac{\pi}{3}\right) y^2(3R - y)$$

when the water is y meters deep.

a. At what rate is the water level changing when the water is 8m deep?

b. What is the radius r of the water's surface when the water is y m deep?

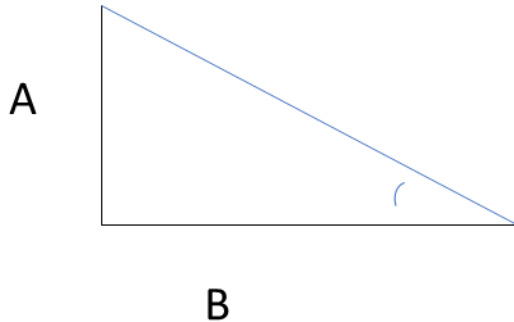
c. At what rate is the radius r changing when the water is 8 m deep?

42. Example a building's shadow

On a morning of a day when the sun will pass directly overhead, the shadow of an 80-ft building on level ground is 60 ft long. At the moment in question, the angle θ the sun makes with the ground is increasing at the rate of $0.27^\circ/\text{min}$. At what rate is the shadow decreasing? (Remember to use radians, express your answer in inches per minute to the nearest tenth.)

43. Example

A and B are walking on straight streets that meet at right angles. A approaches the intersection at 2 m/sec; B moves away from the intersection 1 m/sec. at what rate is the angle θ changing when A is 10 m from the intersection and B is 20 m from the intersection? Express your answer in degrees per second to the nearest degree.



44. Differentiate these functions

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

find the derivatives of the functions: ch3 4,7,14

45. $y = (\theta^2 + \sec \theta + 1)^3$

46. $y = x^7 + \sqrt{7}x - \frac{1}{\pi+1}$

47. $y = x^2 \cot 5x$

48. Find dp/dq for $p^3 + 4pq - 3q^2 = 2$

49. by using chain rule differentiate 3.5

$$f(\theta) = \left(\frac{\sin \theta}{1 + \cos \theta} \right)^2$$

50. Find the areas of the regions enclosed by the lines and curves 46,

$$y = 7 - 2x^2$$

$$\text{and } y = x^2 + 4$$