MATHS

BOOKS - CENGAGE PUBLICATION

GRAPHS OF TRIGONOMETRIC FUNCTIONS

Illustration

1. Plot $y = \sin x and y = \sin 2x$.

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2. Plot $y = \sin x and y = \frac{\sin x}{2}$

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3. Draw the graph of $y = \tan(3x)$

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4. Draw the graph of $y = \sec^2 x - \tan^2 x$. Is $f(x)$ periodic? If yes, what is its fundamental period?

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5. Draw the graph of $y = \sec^2 x - \tan^2 x$. Is $f(x)$ periodic? If yes, what is its fundamental period?

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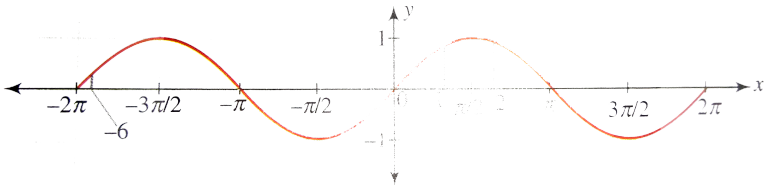
6. Which of the following is highest?

(a) cosec 1 (b) cosec 2

(c) cosec 4 (d) cosec (-6)



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7. Draw the graph of the function $y = f(x) = \lim_{n \to \infty} \cos^{2n} x$ and find its period.

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8. Find the number of solution to the equation $x^2 \tan x = 1, x \in [0, 2\pi]$.

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9. Solve $\tan x > \cot x$, where $x \in [0, 2\pi]$.

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10. Let $f(x) = x \sin \pi x,\ x > 0$. Then for all natural numbers $n,\ f'(x)$ vanishes at (a) A unique point in the interval $\left(n,\ n + \frac{1}{2}\right)$ (b) a unique point in the interval $\left(n + \frac{1}{2},\ n + 1\right)$ (c) a unique point in the interval $(n,\ n + 1)$ (d) two points in the interval $(n,\ n + 1)$

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11. If $0 < \alpha < \frac{\pi}{3}$, then prove that $\alpha(\sec \alpha) < \frac{2\pi}{3}$.

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12. Draw the graph of $y = [\sin x], x \in [0, 2\pi],$ where $[\cdot]$ represents the greatest integer function.

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13. Draw the graph of $f(x) = [\tan x], 0 \leq x \leq 5\pi/12,$ where $[\cdot]$ represents the greatest integer function.

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14. Draw the graph of $f(x) = e^{\sin x}$.

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15. Draw the graph $y = \sin^2 x$.

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16. Draw the graph of $y = (\sin 2x)\sqrt{1 + \tan^2 x}$, find its domain and range.

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17. Draw the graph of $y = \sin^3 x$.

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18. Draw the graph of $y = \sin^3 x$.

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19. Draw the graph of $f(x) = |\sin x| + |\cos x|, x \in R$.

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20. Draw the graph of $f(x) = \sqrt{\sin x}$.

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21. Draw the graph of $y = \dfrac{\cos\left(|x| + \frac{\pi}{2}\right)}{\sin x}$. Is the function periodic ?

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22. Draw the graph of $f(x) = \cos \pi[x]$, where $[\cdot]$ represents the greatest integer function. Find the period of the function.

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23. Draw the graph of $f(x) = \sec x + \text{cosec}\ \ x, x \in (0, 2\pi) - \{\pi/2, \pi, 3\pi/2\}$

Also find the values of 'a' for which the equation $\sec x + \text{cosec}\ \ x = a$ has two distinct root and four distinct roots.

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24. if: $f(x) = \frac{\sin x}{\sqrt{1+\tan^2 x}} - \frac{\cos x}{\sqrt{1+\cot^2 x}}$, then find the range of $f(x)$

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25. Find the area bounded by the following curve :

(i) $f(x) = \sin x, g(x) = \sin^2 x, 0 \leq x \leq 2\pi$

(ii) $f(x) = \sin x, g(x) = \sin^4 x, 0 \leq x \leq 2\pi$

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26. Write the equivalent (piecewise) definition of $f(x) = sgn(\sin x)$.

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27. Draw the graph of $f(x) = \{\sin x\}$, where $\{\cdot\}$ represents the fractional part function.

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28.

Draw a graph of $f(x) = \sin\{x\}$, where $\{x\}$ represents the greatest integer function.

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29. Draw the graph of $f(x)$ maximum $\{2\sin x, 1 - \cos x\}, x \in (0, \pi)$. Also find the range of $g(x)$ min $\{2\sin x, 1 - \cos x\}, x \in (0, \pi)$

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30. Draw the graph of $y = \log_e(\sin x)$.

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31. Draw the graph of $[y] = \sin x, x \in [0, 2\pi]$ where $[\cdot]$ denotes the greatest integer function

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32. Draw the graph of $y = x \sin x$.

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33. Draw the graph of $y = e^x \sin 2\pi x$.

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34. Let [x] denotes the greatest integer less than or equal to x. If $f(x) = [x \sin \pi x]$, then $f(x)$ is

A. a. continuous at x=0

B. b. continuous in (-1,0)

C. c. differentiable at x=1

D. d. differentiable in (-1,1)

Answer:

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35. Evaluate : $\left[\lim_{x \to 0} \frac{\sin x}{x}\right]$, where $[\cdot]$ represents the greatest integer function.

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36. Discuss the extrema of $f(x) = \frac{x}{1 + x \tan x}, x \in \left(0, \frac{\pi}{2}\right)$

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37. Find the values of a if equation $1 - \cos x = \frac{\sqrt{3}}{2}|x|xa, x \in (0, \pi)$, has exactly one solution.

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38. Find the number of solutions of the equation $\sin x = x^2 + x + 1$.

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39. Prove that $\sin x + 2x \geq \frac{3x(x+1)}{\pi}, \forall x \in \left[0, \frac{\pi}{2}\right]$ (Justify the

inequality, if any used).

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40. Find the ratio of the areas of two regions of the curve $C_1 \equiv 4x^2 + \pi^2 y^2 = 4\pi^2$ divided by the curve $C_2 \equiv y = -\left(sgn\left(x - \frac{\pi}{2}\right)\right)\cos x$ (where sgn (x) = signum (x)).

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41. Solve $\tan x < 2$.

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42. Solve $\sin x \succ \frac{1}{2}$ or find the domain of $f(x) = \frac{1}{\sqrt{1+2\sin x}}$

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43. Solve : $2\cos^2\theta + \sin\theta \leq 2$, where $\frac{\pi}{2} \leq \theta \leq \frac{3\pi}{2}$.

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44. Solve `sintheta+sqrt(3)costhetageq1,-pi

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45. Let $f(x) = \begin{cases} x^2 + 3x, & -1 \leq x < 0 \\ -\sin x, & 0 \leq x < \pi/2 \\ -1 - \cos x, & \frac{\pi}{2} \leq x \leq \pi \end{cases}$.

Draw the graph of the function and find the following

(a) Range of the function

(b) Point of inflection

(c) Point of local minima

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46. If $0<x_1<x_2<x_3<\pi$, then prove that $\sin\left(\frac{x_1 + x_2 + x_3}{3}\right) > \frac{\sin x_1 + \sin x_2 + \sin x_3}{3}$.

Hence or otherwise prove that if A, B, C are angles

of a triangle, then the maximum value of $\sin A + \sin B + \sin C$ is $\frac{3\sqrt{3}}{2}$

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Exercises

1. Draw the graph of $y = \text{cosec}^2 x - \cot^2 x$. Is f(x) periodic ? If yes, what is its fundamental period ?

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2. Draw the graph of $y = \cos \pi x$.

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3. Draw the graph of $y = \cos^2 x$.

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4. Find the value of x for which $f(x) = \sqrt{\sin x - \cos x}$ is defined, $x \in [0, 2\pi)$.

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5. Draw the graph of $y = \tan^2 x$.

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6. Draw the graph of $y = \sin x + \cos x, x \in [0, 2\pi]$.

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7. Draw the graph of $y = [\cos x], x \in [0, 2\pi]$, where $[\cdot]$ represents the greatest integer function.

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8. Draw the graph of $y = \sin \pi\sqrt{x}$.

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9. The number of roots of the equation $x \sin x = 1, x \in [-2\pi, 0) \cup (0, 2\pi]$ is (a) 2 (b) 3 (c) 4 (d) 0

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10. Evaluate : $\left[\lim_{x \to 0} \frac{\tan x}{x}\right]$, where $[\cdot]$ represents the greatest integer function.

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11. For $f(x) = \sin x - x^2 + 1$, check weather the function is increasing, decreasing or has a point of extremum ?

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12. Draw the graph of the function $f(x) = max\{\sin x, \cos 2x\}, x \in [0, 2\pi]$. Write the equivalent definition of $f(x)$ and find the range of the function.

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13. Draw the graph of $[y] = \sin x, x \in [0, 2\pi]$ where $[\cdot]$ denotes the greatest integer function

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14. The total number of solution of $\sin\{x\} = \cos\{x\}$ (where $\{\}$ denotes the fractional part) in $[0, 2\pi]$ is equal to 5 (b) 6 (c) 8 (d) none of these

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15. Draw the graph of $f(x) = |\sin x| + |\cos x|, x \in R.$

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16. Find the number of solutions to $\cos x = \frac{x}{10}, x > 0.$

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17. The number of solutions of $\tan x - mx = 0, m > 1,$ in $\left(-\frac{\pi}{2}, \frac{\pi}{2} \right)$ is 1 (b) 2 (c) 3 (d) m

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18. Find the number of solutions to $\log_e|\sin x| = -x^2 + 2x$ in $\left[-\frac{\pi}{2}, \frac{3\pi}{2}\right]$.

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19. Solve : $\cos x \leq -\frac{1}{2}$.

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20. Prove that the least positive value of x, satisfying $\tan x = x + 1, lies in the interval \left(\frac{\pi}{4}, \frac{\pi}{2}\right)$.

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21. Draw the graph of $y = \frac{x^2}{10} \sin x$.

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22. Draw the graph of $y = \frac{\sin x}{x}$.

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