MATHS

BOOKS - SURA MATHS (TAMIL ENGLISH)

TRIGONOMETRY

Exercise 3 1

1. Identify the quadrant in which an angle of each given measure lies:

25°

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2. Identify the quadrant in which an angle of each given measure lies:

825°

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3. Identify the quadrant in which an angle of each given measure lies:

-55°

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4. Identify the quadrant in which an angle of each given measure lies:

328°

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5. Identify the quadrant in which an angle of each given measure lies:

-230°

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6. For each given angle, find a co-terminal angle with measure of θ such that $0^\circ \leq \theta \leq 360^\circ$

395°

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7. For each given angle, find a co-terminal angle with measure of θ such that $0^\circ \leq \theta \leq 360^\circ$

525°

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8. For each given angle, find a co-terminal angle with measure of θ such that $0^\circ \leq \theta \leq 360^\circ$

1150°

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9. For each given angle, find a co-terminal angle with measure of θ such that $0^\circ \leq \theta \leq 360^\circ$

-270°

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10. For each given angle, find a co-terminal angle with measure of θ such that $0^\circ \leq \theta \leq 360^\circ$

-450°

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11. If a cos θ - b sinθ = c, show that a sin θ + b cos $\theta = \pm\sqrt{a^2+b^2-c^2}$

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12. If sin θ + cos θ = m, show that

$\cos^6\theta+\sin^6\theta=\frac{4-3\left(m^2-1\right)^2}{4}$ where $m^2 \leq 2$.

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13. If $\frac{\cos^4\alpha}{\cos^2\beta}+\frac{\sin^4\alpha}{\sin^2\beta}$ = 1, prove that

$\sin^4\alpha+\sin^4\beta=2\sin^2\alpha\sin^2\beta$

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14. If $\frac{\cos^4\alpha}{\cos^2\beta}+\frac{\sin^4\alpha}{\sin^2\beta}=1$, prove that

$$\frac{\cos^4\beta}{\cos^2\alpha}+\frac{\sin^4\beta}{\sin^2\alpha}=1$$

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15. If $y=\frac{2\sin\alpha}{1+\cos\alpha+\sin\alpha}$ then, prove that $\frac{1-\cos\alpha+\sin\alpha}{1+\sin\alpha}=y.$

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16. If $x=\sum_{n=0}^{\infty}\cos^{2n}\theta,\quad y=\sum_{n=0}^{\infty}\sin^{2n}\theta$ and

$z=\sum_{n=0}^{\infty}\cos^{2n}\theta\sin^{2n}\theta, 0<\theta<\frac{\pi}{2}$, then show that

xyz = x + y + z

[Hint : use the formula $1+x+x^2+x^3$ +...

$=\frac{1}{1-x}$, where |x| <1]

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17. If $\tan^2\theta = 1 - k^2$, show that sec θ + $\tan^3\theta$ cosec $\theta = \left(2 - k^2\right)^{3/2}$. Also, find the values of k for which this result holds.

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18. If sec $\theta + \tan\theta = p$, obtain the values of sec θ, tan θ and sin θ in terms of p.

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19. If cot θ(1 + sinθ) = 4m and cot θ (1 - sin θ) = 4n, prove that $\left(m^2 - n^2\right)^2$ = mn.

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20. If $\operatorname{cosec}\theta - \sin\theta = a^3$ and $\sec\theta - \cos\theta = b^3$, then prove that $a^2b^2\left(a^2 + b^2\right) = 1.$

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21. Eliminate θ from the equations a sec θ - c tan θ = b and b sec θ + d tan θ = c.`

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Exercise 3 2

1. Express each the angles in radian measure.

30°

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2. Express each the angles in radian measure.

135°

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3. Express each the angles in radian measure.

-205°

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4. Express each the angles in radian measure.

150°

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5. Express each the angles in radian measure.

330°

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6. Find the degree measure corresponding to the radian measures.

$\frac{8\pi}{3}$

A. 660°

B. 440°

C. 480°

D. 640°

Answer: C

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7. Find the degree measure corresponding to the radian measures.

$\frac{5\pi}{9}$

A. 100°

B. 200°

C. 150°

D. 110°

Answer: A

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8. Find the degree measure corresponding to the radian measures.

$\frac{2\pi}{5}$

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9. Find the degree measure corresponding to the radian measures.

$$\frac{7\pi}{3}$$

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10. Find the degree measure corresponding to the radian measures.

$$\frac{10\pi}{9}$$

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11. What must be the radius of a circular running path, around which an athlete must run 5 times in order to describe 1 km?

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12. In a circle of diameter 40 cm, a chord is of length 20 cm. find the length of the minor are of the chord.

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13. Find the degree measure of the angle subtended at the centre of circle of radius 100 cm by an are of length 22 cm.

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14. What is the length of the are intercepted by a central angle of measure 41° in a circle of radius 10 ft?

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15. If in two circles, arcs of same length subtend angles 60° and 75° at the centre, find the ratio of their radii?

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16. The perimeter of certain sector of a circle is equal to the length of the a semi-circle having the same radius. Express the angle of the sector in degress, minutes and seconds.

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17. An airplane propeller rotates 1000 times per minute. Find the number of degrees that a point on the edge of the propeller will rotate in 1 second.

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18. A train is moving on a circular track of 1500 m radius at the rate of 66 km/hr. what angle will it turn in 20 seconds?

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19. A circular metallic plate of radius 8 cm and thickness 6 mm is melted and molded into a pie (a sector of the circle with thickness) of radius 16 cm and thickness 4 mm. Find the angle of the sector. $= \frac{3}{4}\pi$ radians.

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Exercise 3 3

1. Find the values of

$\sin(480^\circ)$

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2. Find the values of

sin (-1110°)

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3. Find the values of

cos(300°)

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4. Find the values of

tan (1050°)

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5. Find the values of

$\cot(660^\circ)$

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6. Find the values of

$\tan\left(\frac{19\pi}{3}\right)$

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7. Find the values of

$\sin\left(-\frac{11\pi}{3}\right)$.

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8. $\left(\frac{5}{7}\frac{2\sqrt{6}}{7}\right)$ is a point on the terminal side of an angle θ in standard position. Determine the trigonometric function values of angle θ.

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9. Find the values of other five trigonometric functions.

$\cos\theta = -\frac{1}{2}$, θ lies in the III quadrant.

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10. Find the values of other five trigonometric functions.

$\cos\theta = \frac{2}{3}$, θ lies in the I quadrant.

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11. Find the values of other five trigonometric functions.

$\sin\theta = -\frac{2}{3}$, θ lies in the IV quadrant.

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12. Find the values of other five trigonometric functions.

$\tan\theta = -2$, θ lies in the II quadrant

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13. Find the values of other five trigonometric functions.

$\sec\theta = \frac{13}{5}$, θ lies in the IV quadrant.

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14. Find the values of other five trigonometric functions.

$\sec\theta = \frac{13}{5}$, θ lies in the IV quadrant.

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15. Prove that

$$-\frac{\cot(180^\circ + \theta)\sin(90^\circ - \theta)\cos(-\theta)}{\sin(270^\circ + \theta)\tan(-\theta)\cos ec(360^\circ + \theta)} = \cos^2\theta\cot\theta.$$

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16. Find all the angles between 0° and 360° which satisfy the equation $\sin^2\theta = \frac{3}{4}$

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17. Show that $\sin^2\frac{\pi}{18} + \sin^2\frac{\pi}{9} + \sin^2\frac{7\pi}{18} + \sin^2\frac{4\pi}{9} = 2.$

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Exercise 3 4

1. If sin x = $\frac{15}{17}$ and cos y = $\frac{12}{13}, 0 < x < \frac{\pi}{2}, 0 < y < \frac{\pi}{2},$

find the values of

sin (x + y)

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2. If sin x = $\frac{15}{17}$ and cos y = $\frac{12}{13}, 0 < x < \frac{\pi}{2}, 0 < y < \frac{\pi}{2},$

find the values of

cos(x - y)

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3. If $\sin x = \frac{15}{17}$ and $\cos y = \frac{12}{13}, 0 < x < \frac{\pi}{2}, 0 < y < \frac{\pi}{2},$

find the values of

$\tan(x + y)$

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4. If $\sin A = \frac{3}{5}$ and $\cos B = \frac{9}{41}, 0 < A < \frac{\pi}{2}, 0 < B < \frac{\pi}{2}$

Find the value of

$\sin (A + B)$

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5. If $\sin A = \frac{3}{5}$ and $\cos B = \frac{9}{41}, 0 < A < \frac{\pi}{2}, 0 < B < \frac{\pi}{2}$

Find the value of

$\cos (A - B)$

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6. Find cos (x - y), given that cos x = $-\frac{4}{5}$ with $\pi < x < \frac{3\pi}{2}$ and sin y = $-\frac{24}{25}$ with $\pi < y < \frac{3\pi}{2}$.

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7. Find sin (x - y) given that sin x = $\frac{8}{17}$ with $0 < x < \frac{\pi}{2}$ and cos y = $-\frac{24}{25}$ with $\pi < y < \frac{3\pi}{2}$.

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8. Find the value of

cos 105°

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9. Find the value of

$\sin 105^\circ$

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10. Find the value of

$\tan \frac{7\pi}{12}$

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11. Prove that

$\cos(30^\circ + x) = \frac{\sqrt{3}\cos x - \sin x}{2}$

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12. Prove that

$\cos(\pi + \theta) = -\cos\theta$

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13. Prove that

$\sin(\pi + \theta) = -\sin\theta$

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14. Find a quadratic equation whose roots are sin 15° and cos 15°

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15. Expand cos (A + B + C). Hence prove that cos A cos B cos C = sin A sin B cos C + sin B sin C

cos A + sin C sin A cos B, if A + B + C = $\frac{\pi}{2}$.

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16. Prove that

$\sin(45^\circ + \theta) - \sin(45^\circ - \theta) = \sqrt{2}\sin\theta$

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17. Prove that

$\sin(30^\circ + \theta) + \cos(60^\circ + \theta) = \cos\theta$

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18. If a cos (x + y) = b cos (x - y), show that (a + b)tan x = (a - b) cot y.

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19. Prove that $\sin 105^\circ + \cos 105^\circ = \cos 45^\circ$

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20. Prove that $\sin 75^\circ - \sin 15^\circ = \cos 105^\circ + \cos 15^\circ$

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21. Show that $\tan 75^\circ + \cot 75^\circ = 4$

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22. Prove that cos (A + B) cos C - cos (B + C)

cos A = sin B sin (C - A)

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23. Prove that sin (n + 1)θ sin (n - 1) θ + cos (n + 1)θ cos (n - 1) θ = cos 2θ, n $\in \mathbb{Z}$.

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24. If x cos θ = y cos $\left(\theta + \frac{2\pi}{3}\right)$ = z cos $\left(\theta + \frac{4\pi}{3}\right)$, find the value of xy + yz + zx

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25. Prove that

$\sin(A + B)\sin(A - B) = \sin^2 A - \sin^2 B.$

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26. Prove that

cos (A + B) cos (A - B) = $\cos^2 A - \sin^2 B = \cos^2 B - \sin^2 A$

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27. Prove that

$\sin^2(A + B) - \sin^2(A - B) = \sin 2A \sin 2B$

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28. Prove that

cos 8θ cos 2θ = $\cos^2 5\theta - \sin^2 3\theta$

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29. Show that

$$\cos^2 A + \cos^2 B - 2\cos A \cos B \cos(A+B) = \sin^2(A+B)$$

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30. If $\cos(\alpha-\beta) + \cos(\beta-\gamma) + \cos(\gamma-\alpha) = \frac{-3}{2}$ then prove that $\cos\alpha + \cos\beta + \cos\gamma = \sin\alpha + \sin\beta + \sin\gamma = 0$.

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31. Show that

$$\tan(45^\circ + A) = \frac{1+\tan A}{1-\tan A}$$

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32. Show that

$$\tan(45^\circ - A) = \frac{1 - \tan A}{1 + \tan A}$$

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33. Prove that cot (A + B) = $\frac{\cot A \cot B - 1}{\cot A + \cot B}$

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34. If tan x = $\frac{n}{n+1}$ and tan y = $\frac{1}{2n+1}$, find tan (x + y).

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35. Prove that $\tan\left(\frac{\pi}{4} + \theta\right)\tan\left(\frac{3\pi}{4} + \theta\right) = -1$

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36. Find the values of $\tan(\alpha+\beta)$, given that $\cot\alpha = \frac{1}{2}$ $\alpha \in \left(\pi, \frac{3\pi}{2}\right)$ and $\sec\beta = -\frac{5}{3}, \beta \in \left(\frac{\pi}{2}, \pi\right)$.

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37. If $\theta+\phi=\alpha$ and tan θ = k tan ϕ, then prove that $\sin(\theta-\phi) = \frac{k-1}{k+1}\sin\alpha$.

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Exercise 3 5

1. Find the values of cos 2A, A lies in the first quadrant, when cos A = $\frac{15}{17}$

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2. Find the values of cos 2A, A lies in the first quadrant, when

$\sin A = \frac{4}{5}$

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3. Find the values of cos 2A, A lies in the first quadrant, when

$\tan A = \frac{16}{63}$.

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4. If $\theta$is an acute angle, then find

$\sin\left(\frac{\pi}{4} - \frac{\theta}{2}\right)$ when $\sin\theta = \frac{1}{25}$

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5. If $\theta$is an acute angle, then find

$\cos\left(\frac{\pi}{4}+\frac{\theta}{2}\right)$, when $\sin\theta=\frac{8}{9}$

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6. If $\cos\theta=\frac{1}{2}\left(a+\frac{1}{a}\right)$, show that cos 30 = $\frac{1}{2}\left(a^3+\frac{1}{a^3}\right)$.

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7. Prove that cos 50 = 16 $\cos^5\theta-20\cos^3\theta+5\cos\theta$

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8. Prove that $\sin 4\alpha=4\tan\alpha\frac{1-\tan^2\alpha}{\left(1+\tan^2\alpha\right)^2}$

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9. If A + B = 45° , show that (1 + tan A)(1 + tan B) = 2

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10. Prove that $(1+\tan 1^\circ)(1+\tan 2^\circ)(1+\tan 3^\circ)....$

$(1+\tan 44^\circ)$ is multiple of 4.

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11. Prove that $\tan\left(\frac{\pi}{4}+\theta\right)-\tan\left(\frac{\pi}{4}-\theta\right)=2\tan 2\theta.$

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12. Show that $\cot\left(7\frac{1}{2}\right)=\sqrt{2}+\sqrt{3}+\sqrt{4}+\sqrt{6}.$

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13. Prove that

$(1+\sec 2\theta)(1+\sec 4\theta)\ldots\ldots.(1+\sec 2^n\theta)=\tan 2^n\theta\cot\theta$

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14. Prove that $32\left(\sqrt{3}\right)\sin\frac{\pi}{48}\cos\frac{\pi}{48}\cos\frac{\pi}{24}\cos\frac{\pi}{12}\cos\frac{\pi}{6}=3$

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Exercise 3 6

1. Express each of the following as a sum or difference.

$\sin 35^\circ\cos 28^\circ$

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2. Express each of the following as a sum or difference.

sin 4x cos 2x

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3. Express each of the following as a sum or difference.

2 sin $10\theta \cos 2\theta$

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4. Express each of the following as a sum or difference.

cos 5θ cos 2θ

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5. Express each of the following as a sum or difference.

$\sin 5\theta \sin 4\theta$

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6. Express each as a product

$\sin 75^\circ - \sin 35^\circ$

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7. Express each as a product

$\cos 65^\circ + \cos 15^\circ$

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8. Express each as a product

$\sin 50^\circ + \sin 40^\circ$

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9. Express each as a product

$\cos 35^\circ - \cos 75^\circ$

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10. Show that $\sin 12^\circ \sin 48^\circ \sin 54^\circ = \frac{1}{8}$

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11. Show that $\cos\frac{\pi}{15}\cos\frac{2\pi}{15}\cos\frac{3\pi}{15}\cos\frac{4\pi}{15}\cos\frac{5\pi}{15}\cos\frac{6\pi}{15}\cos\frac{7\pi}{15} = \frac{1}{128}$.

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12. Show that $\frac{\sin 8x \cos x - \sin 6x \cos 3x}{\cos 2x \cos x - \sin 3x \sin 4x} = \tan 2x$

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13. Show that $\frac{(\cos\theta - \cos 3\theta)(\sin 8\theta + \sin 2\theta)}{(\sin 5\theta - \sin\theta)(\cos 4\theta - \cos 6\theta)} = 1$

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14. Prove that sin x + sin 2x + sin 3x = sin 2x (1 + 2 cos x)

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15. Prove that $\frac{\sin 4x + \sin 2x}{\cos 4x + \cos 2x} = \tan 3x.$

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16. Prove that 1 + cos 2x + cos 4x + cos 6x = 4 cos x cos 2x cos 3x

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17. Prove that $\sin\frac{\theta}{2}\sin\frac{7\theta}{2}+\sin\frac{3\theta}{2}\sin\frac{11\theta}{2}=\sin 2\theta\sin 5\theta.$

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18. Prove that cos $(30^\circ - A)\cos(30^\circ + A) + \cos(45^\circ - A)\cos(45^\circ + A) = \cos 2A + \frac{1}{4}$

.

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19. Prove that $\frac{\sin x+\sin 3x+\sin 5x+\sin 7x}{\cos x+\cos 3x+\cos 5x+\cos 7x}=\tan 4x$

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20. Prove that $\frac{\sin(4A-2B)+\sin(4B-2A)}{\cos(4A-2B)+\cos(4B-2A)}=\tan(A+B)$

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21. Show that $\cot(A+15^\circ)-\tan(A-15^\circ)=\frac{4\cos 2A}{1+2\sin 2A}$.

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Exercise 3 7

1. If A + B + C = 180°, prove that

sin 2A + sin 2B + sin 2C = 4 sin A sin B sin C

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2. If A + B + C = 180°, prove that

cos A + cos B - cos C = -1 + 4 cos $\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

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3. If A + B + C = 180°, prove that

$\sin^2 A + \sin^2 B + \sin^2$C = 2 + 2 cos A cos B cos C

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4. If A + B + C = 180°, prove that

$\sin^2 A + \sin^2 B - \sin^2 C$ = 2 sin A sin B cos C

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5. If A + B + C = 180°, prove that

$$\tan\frac{A}{2}\tan\frac{B}{2}+\tan\frac{B}{2}\tan\frac{C}{2}+\tan\frac{C}{2}\tan\frac{A}{2}=1$$

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6. If A + B + C = 180°, prove that

$$\sin A+\sin B+\sin C=4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$$

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7. If A + B + C = 180°, prove that

sin(B + C - A) + sin (C + A - B) +

sin(A + B + C) = 4 sin A sin B sin C.

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8. If A + B + C = 2s, then prove that sin (s - A) sin (s - B) + sin s. sin (s - C) = sin A sin B .

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9. If x + y + z = xyz, then prove that $\frac{2x}{1-x^2}+\frac{2y}{1-y^2}+\frac{2z}{1-z^2}=\frac{2x}{1-x^2}\cdot\frac{2y}{1-y^2}\cdot\frac{2z}{1-z^2}$.

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10. If A + B + C $=\frac{\pi}{2}$, prove that

sin 2A + sin 2B + sin 2C = 4 cos A cos B cos C

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11. If A + B + C $= \frac{\pi}{2}$, prove that

cos 2A + cos 2B + cos 2C = 1 + 4 sin A sin B cos C

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12. If ΔABC is right triangle and if $\angle A = \frac{\pi}{2}$, then prove that

$\cos^2 B + \cos^2 C = 1$

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13. If ΔABC is right triangle and if $\angle A = \frac{\pi}{2}$, then prove that

$\sin^2 B + \sin^2 C = 1$

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14. If ΔABC is right triangle and if $\angle A = \frac{\pi}{2}$, then prove that cos B - cos C = -1 + $2\sqrt{2}\cos\frac{B}{2}\sin\frac{C}{2}$.

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Exercise 3 8

1. Find the principal solution and general solutions :

$\sin\theta = -\frac{1}{\sqrt{2}}$

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2. Find the principal solution and general solutions :

$\cot\theta = \sqrt{3}$

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3. Find the principal solution and general solutions :

$\tan\theta = \frac{-1}{\sqrt{3}}$

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4. Solve the equations for which solution lies in the interval $0^\circ < \theta < 360^\circ$.

$\sin^4 x = \sin^2 x$

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5. Solve the equations for which solution lies in the interval $0^\circ < \theta < 360^\circ$.

$2\cos^2 x + 1 = -3\cos x$

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6. Solve the equations for which solution lies in the interval $0^\circ < \theta < 360^\circ$.

$2\sin^2 x + 1 = 3 \sin x$

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7. Solve the equations for which solution lies in the interval $0^\circ < \theta < 360^\circ$.

$\cos 2x = 1 - 3 \sin x$

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8. Solve the equations:

$\sin 5x - \sin x = \cos 3x$

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9. Solve the equations:

$2\cos^2\theta + 3\sin\theta - 3 = 0$

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10. Solve the equations:

$\cos\theta + \cos 3\theta = 2\cos 2\theta$

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11. Solve the equations:

$\sin\theta + \sin 3\theta + \sin 5\theta = 0$

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12. Solve the equations:

$\sin 2\theta - \cos 2\theta - \sin\theta + \cos\theta = 0$

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13. Solve the equations:

$\sin\theta + \cos\theta = \sqrt{2}$

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14. Solve the equations:

$\sin\theta + \sqrt{3}\cos\theta = 1$

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15. Solve the equations:

$\cot\theta + \cos ec\theta = \sqrt{3}$

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16. Solve the equations:

$$\tan\theta + \tan\left(\theta + \frac{\pi}{3}\right) + \tan\left(\theta + \frac{2\pi}{3}\right) = \sqrt{3}$$

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17. Solve the equations:

$$\cos 2\theta = \frac{\sqrt{5}+1}{4}$$

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18. Solve the equations:

$$2\cos^2 x - 7\cos x + 3 = 0$$

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Exercise 3 9

1. In a $\triangle ABC$, if $\frac{\sin A}{\sin C} = \frac{\sin(A-B)}{\sin(B-C)}$, prove that a^2, b^2, c^2 are in Artithmetic Progression.

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2. The angles of a triangle ABC, are in Arithmetic progression and if b : c = $\sqrt{3}:\sqrt{2}$, find $\angle A$

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3. In a ΔABC, if cos C = $\frac{\sin A}{2\sin B}$, show that the triangle is isosceles.

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4. In a $\triangle ABC$, prove that $\frac{\sin B}{\sin C} = \frac{c - a\cos B}{b - a\cos C}$

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5. In a $\triangle ABC$, prove that a cos A+b cos B+c cos C=2a sin B sin C

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6. In a ΔABC, $\angle A = 60^\circ$, prove that b + c = 2a cos $\left(\frac{B-C}{2}\right)$.

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7. In a ΔABC, prove that

a sin $\left(\frac{A}{2}+B\right) = (b+c)\sin\frac{A}{2}$

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8. In a ΔABC, prove that

$a\,(\cos B + \cos C) = 2\,(b + c)\sin^2\frac{A}{2}$

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9. In a ΔABC, prove that

$$\frac{a^2 - c^2}{b^2} = \frac{\sin(A - C)}{\sin(A + C)}$$

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10. In a ΔABC, prove that

$$\frac{a\sin(B - C)}{b^2 - c^2} = \frac{b\sin(C - A)}{c^2 - a^2} = \frac{c\sin(A - B)}{a^2 - b^2}$$

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11. In a ΔABC, prove that

$$\frac{a+b}{a-b} = \tan\left(\frac{A+B}{2}\right)\cot\left(\frac{A-B}{2}\right)$$

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12. In ΔABC, prove that $\left(a^2 - b^2 + c^2\right)$ tan B = $\left(a^2 + b^2 - c^2\right)$ tan C.

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13. An Engineer has to develop a triangular shaped park with a perimeter 120 m in a village. The park to be developed must be of maximum area. Find out the dimensions of the park.

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14. A rope of length 12 m is given. Find the largest area of the triangle formed by this rope and find the dimensions of the triangle so formed.

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15. Derive projection formula from

Law of sines

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16. Derive projection formula from

Law of cosines

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Exercise 3 10

1. Determine whether the following measurements produce one triangle, two triangles or no triangle $\angle B = 88^\circ$, a = 23 , b = 2. Solve if solution exists.

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2. If the sides of ΔABC are a = 4, b = 6 , c = 8 , then show that 4 cos B + 3 cos C = 2.

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3. In ΔABC, if a = $\sqrt{3}-1, b=\sqrt{3}+1$ and $\angle C = 60^\circ$, find the other side and the other two angles.

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4. In any ΔABC, prove that the area $\Delta = \frac{b^2 + c^2 - a^2}{4 \cot A}$

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5. In a ΔABC, if a = 12 cm, b = 8 cm $\angle C = 30^\circ$, then show that its area is 24 sq.cm.

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6. In a ΔABC, if a = 18 cm, b = 24 cm and c = 30 cm. then show that its area is 216 sq.cm

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7. Two soldiers A and B in two different underground bunkers on a straight road, spot an intruder at the top of a hill. The angle of

elevation of the intruder from A and B to the ground level in the eastern direction are 30° and 45° respectively. If A and B stand 5 km apart, find the distance of the intruder from B.

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8. A researcher wants to determine the width of a pond from east to west, which cannot by done by actual measurement . From a point p, he finds the distance to the eastern-most point of the pond to be 8 km, while the distance to the western most point from P to be 6 km. if the angle between the two lines of sight is 60°, find the width of the pond.

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9. Two Navy helicopters A and B are flying over the bay of Bengal at same altitude from the sea level to search a missing boat. Pilots of

both the helicopters sight the boat the same time while they are part 10 km from each other. If the distance of the boat from A is 6 km and if the line segment AB subtends 60° at the boat, find the distance of the boat from B.

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10. A straight tunnel is to be made through a mountain. A surveyor observer the two extremities A and B of the tunnel to be built from a point P in front of the mountain. If AP = 3 km, BP = 5 km and $\angle APB = 120^\circ$, then find the length of the tunnel to be built .

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11. A farmer wants to purchase a triangular shaped land with sides 120 feet and 60 feet and the angle included between these two sides

is 60°. If the land costs ₹ 500 per sq. ft. find the amount he needed to purchase the land. Also, find the perimeter of the land.

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12. A fighter jet has to hit a small target by flying a horizontal distance. When the target is sighted, the pilot measures the angle of depression to be 30°. If after 100 km, the target has an angle of depression of 45°, how far is the target from the fighter jet at that instant?

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13. A plane is 1 km from one landmark and 2 km from another. From the planes point of view the land between them subtends an angle of 45° . How far apart are the landmarks?

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14. A man starts his morning walk at a point A reaches two points B and C and finally back to A such that $\angle A = 60^\circ$ and $\angle B = 45^\circ$, AC = 4 km in ΔABC. Find the total distance he covered during his morning walk.

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15. Two vehicles leave the same place P at the same time moving along two different roads. One vehicle moves at an average speed of 60km/hr and the other vehicle moves at an average speed of 80km/hr. After half an hour the vehicle reach the destinations A and B. If AB subtends 60° at the initial point. P, then find AB.

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16. Suppose that a satellite in space, an earth station and the centre of earth all lie in the same plane. Let r be the radius of earth and R be the distance from the centre of earth to the satellite. Let d be the distance from the earth station from the satellite. Let 30° be the angle of elevation from the earth station to the satellite. if the line segment connecting earth station and satellite subtends angle α at the centre of earth, then prove that

$$d = R\sqrt{1 + \left(\frac{r}{R}\right)^2 - 2\frac{r}{R}\cos\alpha}.$$

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Exercise 3 11

1. Find the principal value of

$$\sin^{-1}\frac{1}{\sqrt{2}}$$

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2. Find the principal value of

$\cos^{-1}\frac{\sqrt{3}}{2}$

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3. Find the principal value of

$\text{cosec}^{-1}(-1)$

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4. Find the principal value of

$\sec^{-1}(-\sqrt{2})$

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5. Find the principal value of

$\tan^{-1}(\sqrt{3})$

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6. A man standing directly opposite to one side of a road of width x meter views a circular shaped traffic green signal of diameter a meter on the other side of the road. The bottom of the green signal is b meter height from the horizontal level of viewer's eye. If a denotes the angle subtended by the diameter of the green signal at the viewer's eye, then prove that

$\alpha = \tan^{-1}\left(\frac{a+b}{x}\right) - \tan^{-1}\left(\frac{b}{x}\right).$

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Exercise 3 12

1. $\frac{1}{\cos 80^\circ} - \frac{\sqrt{3}}{\sin 80^\circ} =$

A. $\sqrt{2}$

B. $\sqrt{3}$

C. 2

D. 4

Answer: D

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2. If $\cos 28^\circ + \sin 28^\circ = k^3$, then $\cos 17^\circ$ is equal to

A. $\frac{k^3}{\sqrt{2}}$

B. $-\frac{k^3}{\sqrt{2}}(3)$

C. $\pm\frac{k^3}{\sqrt{2}}$

D. $-\frac{k^3}{\sqrt{3}}$

Answer: B::C

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3. The maximum value of $4\sin^2 x + 3\cos^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$ is

A. $4 + \sqrt{2}$

B. $3 + \sqrt{2}$

C. 9

D. 4

Answer: B::D

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4. $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\cos\frac{7\pi}{8}\right) =$

A. $\frac{1}{8}$

B. $\frac{1}{2}$

C. $\frac{1}{\sqrt{3}}$

D. $\frac{1}{\sqrt{2}}$

Answer: A

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5. If $\pi < 2\theta < \frac{3\pi}{2}$, then $\sqrt{2+\sqrt{2+2\cos 4\theta}}$ equals to

A. $-2\cos\theta$

B. $-2\sin\theta$

C. $2\cos\theta$

D. $2\sin\theta$

Answer: A::B::C

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6. If $\tan 40^\circ = \lambda$, then $\frac{\tan 140^\circ - \tan 130^\circ}{1 + \tan 140^\circ \tan 130^\circ}$ =

A. $\frac{1 - \lambda^2}{\lambda}$

B. $\frac{1 + \lambda^2}{\lambda}$

C. $1 + \lambda^2 \frac{)}{2\lambda}$

D. $\frac{1 - \lambda^2}{2\lambda}$

Answer: A::B::D

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7. $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \ldots + \cos 179^\circ$ =

A. 0

B. 1

C. -1

D. 89

Answer:

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8. Let $f_4(x) = \frac{1}{k}\left[\sin^k + \cos^k x\right]$ where x $\in \mathbb{R}$ and $k \geq 1$.

then $f_4(x) - f_6(x)$ =

A. $\frac{1}{4}$

B. $\frac{1}{12}$

C. $\frac{1}{6}$

D. $\frac{1}{3}$

Answer: A::B

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9. Which of the following is not true?

A. $\sin\theta = -\frac{3}{4}$

B. $\cos\theta = -1$

C. $\tan\theta = 25$

D. $\sec\theta = \frac{1}{4}$

Answer: A::C::D

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10. $\cos 2\theta \cos 2\phi + \sin^2(\theta - \phi) - \sin^2(\theta + \phi)$ is equal to

A. $\sin 2(\theta + \phi)$

B. $\cos 2(\theta + \phi)$

C. $\sin 2(\theta - \phi)$

D. $\cos 2(\theta - \phi)$

Answer: A::B::C

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11. $\frac{\sin(A-B)}{\cos A \cos B} + \frac{\sin(B-C)}{\cos B \cos C} + \frac{\sin(C-A)}{\cos C \cos A}$ is

A. sinA + sinB + sinC

B. 1

C. 0

D. cosA + cosB + cosC

Answer:

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12. If cos $p\theta$ + cos $q\theta$ = 0 and if p $\neq$ q, then θ is equal to (n is any integer)

A. $\frac{\pi(3n+1)}{p-q}$

B. $\frac{\pi(2n+1)}{p-q}$

C. $\frac{\pi(n\pm 1)}{p\pm q}$

D. $\frac{\pi(n+2)}{p+q}$

Answer: A::B

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13. If tan α and tan β are the roots of $x^2+ax+b=0$, then $\frac{\sin(\alpha+\beta)}{\sin\alpha\sin\beta}$ is equal to

A. $\frac{b}{a}$

B. $\frac{a}{b}$

C. $-\frac{a}{b}$

D. $-\frac{b}{a}$

Answer: A::B

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14. In a triangle ABC, $\sin^2 A + \sin^2 B + \sin^2 C = 2$, then the triangle is

A. equilateral triangle

B. isosceles triangle

C. right triangle

D. scalene triangle

Answer: A

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15. If $f(\theta) = |\sin\theta| + |\cos\theta|, \theta \in \mathbb{R},$ then $f(\theta)$ is in the interval

A. [0,2]

B. $[1,\sqrt{2}]$

C. [1,2]

D. [0,1]

Answer: A::B

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16. $\dfrac{\cos 6x + 6\cos 4x + 15\cos 2x + 10}{\cos 5x + 5\cos 3x + 10\cos x}$ is equal to

A. cos 2x

B. cos x

C. cos 3x

D. 2 cos x

Answer: B::C

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17. The triangle of maximum area with constant perimeter 12m

A. is an equilateral triangle with side 4 m

B. is an isosceles triangle with sides 2m, 5m, 5m

C. is a triangle with sides 3m, 4m, 5m

D. Does not exist.

Answer: A::D

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18. A wheel is spinning at 2 radians/second. How many seconds will it take to make 10 complete rotations?

A. 10π seconds

B. 20π seconds

C. 5π seconds

D. 15πseconds

Answer: A::C::D

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19. If $\sin\alpha + \cos\alpha$= b, then sin 2α is equal to

A. $b^2 - 1, \quad \text{if} \quad b \leq \sqrt{2}$

B. $b^2 - 1, \quad \text{if} \quad b > \sqrt{2}$

C. $b^2 - 1, \quad \text{if} \quad b \geq 1$

D. $b^2 - 1, \quad \text{if} \quad b \geq \sqrt{2}$

Answer: A::B

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20. In a ΔABC, if

(i)$\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} > 0$ (ii)$\sin A \sin B \sin C > 0$

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21. In a ΔABC, if

(i)$\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} > 0$ (ii)$\sin A \sin B \sin C > 0$

A. Both (i) and (ii) are true

B. Only (i) is true

C. Only (ii) is true

D. Neither (i) nor (ii) is true

Answer: A::B::D

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Additional Problems Section A 1 Mark

1. $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \ldots + \cos 179^\circ =$

A. 0

B. 1

C. -1

D. 89

Answer:

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2. If $\sec\theta = x + \frac{1}{4x}$, then $\sec\theta + \tan\theta$=

A. x, $\frac{1}{x}$

B. $2x$, $\frac{1}{2x}$

C. $-2x$, $\frac{1}{2x}$

D. $-x$, $\frac{1}{x}$,x

Answer: A::B

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3. The value of $\sin\left(\cos^{-1}\frac{5}{13}\right)$

A. $\frac{12}{13}$

B. $\frac{5}{13}$

C. $\frac{5}{12}$

D. 1

Answer: A::B::C

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4. $\frac{\cos 10^\circ - \sin 10^\circ}{\cos 10^\circ + \sin 10^\circ}$ is

A. $\tan 35^\circ$

B. $\sqrt{3}$

C. $\tan 75^\circ$

D. 1

Answer: A::C

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5. If the angles of a triangle are in A.P., then the measure of one of the angles in radians is

A. $\frac{\pi}{6}$

B. $\frac{\pi}{3}$

C. $\frac{\pi}{2}$

D. $\frac{2\pi}{3}$

Answer: C

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6. If cosec x + cot x = $\frac{11}{2}$ then tan x =

A. $\frac{21}{22}$

B. $\frac{15}{16}$

C. $\frac{44}{117}$

D. $\frac{117}{44}$

Answer: A::D

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7. Choose the incorrect pair :

A. sin x $x \in \mathbb{R}$

B. cos x $x \in \mathbb{R}$

C. log x $x > 0$

D. e^{-x} $x > 0$

Answer:

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8. Assertion (A) : cos x = $\frac{-1}{2}$ and 0 lt x lt 2pi, then the solutions are $x = \frac{2\pi}{3}, \frac{4\pi}{3}$.

Reason (R) : cos is negative in the first and fourth quadrant only

A. both A and (R) are true and (R) is the correct

B. Both A and R are true but (R) is not the correct explantion of A

C. A is true R is false

D. A is false R is true

Answer: C

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9. Choose the incorrect pair:

A. sin x in II^{nd} quadrant $\frac{-1}{5}$

B. cos x in I^{nd} quadrant 1

C. sec x in II^{nd} quadrant -2

D. tan x in III^{nd} quadrant 20

Answer: A::D

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10. Mark the correct statement of the following

A. For fixed perimeter , right triangle have maximum area

B. for fixed perimeter, equilateral triangle have maximum area

C. for fixed perimeter, isosceles triangle have maximum area

D. for fixed perimeter, scalene triangle have maximum area

Answer: A::D

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11. Match list - I with list II

ListI	List II
sin 2A	$\cos^2 A - \sin^2 A$
cos 2A	$2 \sin A \cos A$
sin 3A	$2\frac{\sin(A)}{2}\frac{\cos(A)}{2}$
sin A	$3 \sin A - 4 \sin^3 A$

A.

(i)	(ii)	(iii)	(iv)
b	a	d	c

B.

(i)	(ii)	(iii)	(iv)
c	d	b	a

C.

(i)	(ii)	(iii)	(iv)
d	c	b	a

D.

(i)	(ii)	(iii)	(iv)
c	a	b	d

Answer: B::C::D

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12. Find the odd one out of the following

A. $\frac{1}{2}$ ab sin C

B. $\frac{1}{2}$ bc sin A

C. $\sqrt{s(s-a)(s-b)(s-c)}$

D. $\sqrt{\frac{(s-b)(s-c)}{bc}}$

Answer: B::C

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13. Find the incorrect pair

A. $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \quad 2R$

B. $\frac{b^2+c^2-a^2}{2bc} = \cos A$

C. $\frac{a-b}{a+b}\cot\frac{c}{2} = \frac{\tan(A-B)}{2}$

D. $\frac{a^2+c^2-b^2}{2ac} = \cos C$

Answer: A::B::C

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14. Choose the incorrect statement

A. sin x lies in the interval [-1,1]

B. cos x lies in the interval [-1,1]

C. tan x lies in the interval p $[-\infty, \infty]$

D. cos x lies in the inverval $[-1, \infty]$

Answer: A::C

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Section B 2 Marks

1. Solve: tan 2x = - cot $\left(x+\frac{\pi}{3}\right)$.

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2. Simplify : sin $100^\circ + \cos 100^\circ$.

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3. Prove that tan 315° cot (-405°) + cot 495° tan (-585°) = 2

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4. Find the radian mesures of (i) -37° 30' (ii) 40° 20'.

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5. Prove that $\sin^6 x + \cos^6 x = 1 - 3\sin^2 x \cos^2 x$.

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6. Find the values of cos x and tan x if sin x = $-\frac{3}{5}$ and $\pi < x < \frac{3\pi}{2}$.

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7. Evaluate (i) tan 480° (ii) sin $\left(\frac{-11\pi}{3}\right)$.

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Section C 3 Marks

1. Suppose that a boat travels 10 km from the port towards east and then turns 60° to its left. If the boat travels further 8 km, how far

from the port is the boat?

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2. In ΔABC, if $\tan\frac{A}{2}=\frac{5}{6}$ and $\tan\frac{C}{2}=\frac{2}{5}$, then show that a,b,c, are in A.P.

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Section D

1. The Government plans to have circular zoological park of diameter 8 km. A separate area in the form of a segment formed by a chord of length 4 km is to allotted exclusively for a veterinary hospital in the park find the area of the segment to be allotted for the veterinary hospital.

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2. Prove that $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$

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3. Two trees A and B on the same side of a river from a point C in the river, the distances of the trees A and B are 250 m and 300 m respectively. If the angle C is 45°, find the distance between the trees.

$\left(\sqrt{2} = 1.414\right)$

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4. Prove that $\sin\frac{10\pi}{3}\frac{\cos(13\pi)}{6} + \frac{\cos(8\pi)}{3}\frac{\sin(5\pi)}{6} = -1$

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5. If the sides of a ΔABC are a = 4, b = 6 and c = 8, show that 4 cos B + 3 cos C = 2.