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Mob: +974 55249797 / 55258711

E-mail: rashed.saba@gmail.com

Pure Mathematics-1

TOPIC- Trigonometry

TRIGONOMETRY-Identity

1 Prove the identity $\frac{\sin x}{1 - \sin x} - \frac{\sin x}{1 + \sin x} \equiv 2 \tan^2 x$.

[3]



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Mob: +974 55249797 / 55258711

E-mail: rashed.saba@gmail.com

2 Prove the identity

$$\frac{1 + \sin x}{\cos x} + \frac{\cos x}{1 + \sin x} \equiv \frac{2}{\cos x}$$

[4]

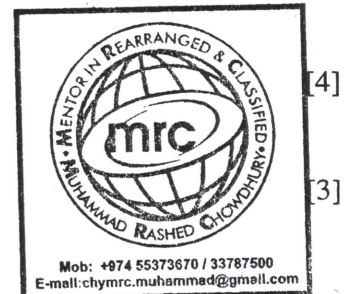
TRIGONOMETRY-Identity

- 3 (i) Show that the equation $\sin^2 \theta + 3 \sin \theta \cos \theta = 4 \cos^2 \theta$ can be written as a quadratic equation in $\tan \theta$. [2]
- (ii) Hence, or otherwise, solve the equation in part (i) for $0^\circ \leq \theta \leq 180^\circ$. [3]

37-4
3

- 4 (i) Prove the identity $\left(\frac{1}{\sin x} - \frac{1}{\tan x}\right)^2 \equiv \frac{1 - \cos x}{1 + \cos x}$. [4]
- (ii) Hence solve the equation $\left(\frac{1}{\sin x} - \frac{1}{\tan x}\right)^2 = \frac{2}{5}$ for $0 \leq x \leq 2\pi$. [3]

2-15-12-7



TRIGONOMETRY-Identity

7-14-12
5

- 5 (i) Show that the equation $1 + \sin x \tan x = 5 \cos x$ can be expressed as

$$6 \cos^2 x - \cos x - 1 = 0.$$

- (ii) Hence solve the equation $1 + \sin x \tan x = 5 \cos x$ for $0^\circ \leq x \leq 180^\circ$.



- 6 (i) Show that $\cos^4 x \equiv 1 - 2 \sin^2 x + \sin^4 x$.

[1]

- (ii) Hence, or otherwise, solve the equation $8 \sin^4 x + \cos^4 x = 2 \cos^2 x$ for $0^\circ \leq x \leq 360^\circ$.

[5]

7-16-11
7

TRIGONOMETRY-Identity

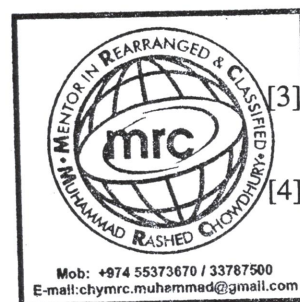
2-16-12-7

7 (i) Prove the identity $\frac{1 + \cos \theta}{1 - \cos \theta} - \frac{1 - \cos \theta}{1 + \cos \theta} \equiv \frac{4}{\sin \theta \tan \theta}$. [4]

5-11-13

8 (i) Prove the identity $\left(\frac{1}{\sin \theta} - \frac{1}{\tan \theta}\right)^2 \equiv \frac{1 - \cos \theta}{1 + \cos \theta}$.

(ii) Hence solve the equation $\left(\frac{1}{\sin \theta} - \frac{1}{\tan \theta}\right)^2 = \frac{2}{5}$, for $0^\circ \leq \theta \leq 360^\circ$.



TRIGONOMETRY-Identity

- 9 (i) Prove the identity $\frac{\sin \theta}{1 - \cos \theta} - \frac{1}{\sin \theta} \equiv \frac{1}{\tan \theta}$. [4]
- (ii) Hence solve the equation $\frac{\sin \theta}{1 - \cos \theta} - \frac{1}{\sin \theta} = 4 \tan \theta$ for $0^\circ < \theta < 180^\circ$. [3]

- 10 (i) Prove the identity $\tan^2 \theta - \sin^2 \theta \equiv \tan^2 \theta \sin^2 \theta$.
- (ii) Use this result to explain why $\tan \theta > \sin \theta$ for $0^\circ < \theta < 90^\circ$.



TRIGONOMETRY-Identity

- 57-10-12
1
- 11 (i) Show that the equation

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

can be written in the form $\tan x = -\frac{3}{4}$.

[2]

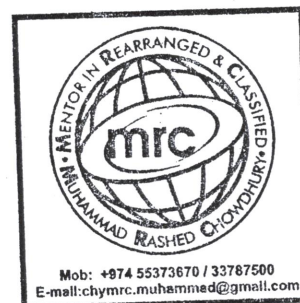
- (ii) Solve the equation $3(2 \sin x - \cos x) = 2(\sin x - 3 \cos x)$, for $0^\circ \leq x \leq 360^\circ$.

[2]

- 7-10-12
2
- 12 Prove the identity

$$\tan^2 x - \sin^2 x \equiv \tan^2 x \sin^2 x.$$

4]



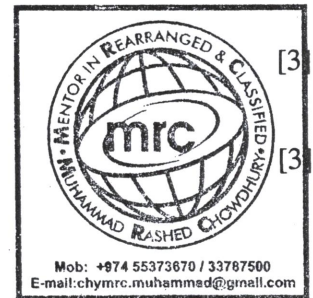
TRIGONOMETRY-Identity

13 (i) Show that the equation $\sin \theta + \cos \theta = 2(\sin \theta - \cos \theta)$ can be expressed as $\tan \theta = 3$. [2]

(ii) Hence solve the equation $\sin \theta + \cos \theta = 2(\sin \theta - \cos \theta)$, for $0^\circ \leq \theta \leq 360^\circ$. [2]

14 (i) Prove the identity $\frac{\sin x \tan x}{1 - \cos x} \equiv 1 + \frac{1}{\cos x}$.

(ii) Hence solve the equation $\frac{\sin x \tan x}{1 - \cos x} + 2 = 0$, for $0^\circ \leq x \leq 360^\circ$.



TRIGONOMETRY-Identity

5-14-14
5

(i) Prove the identity $\frac{1}{\cos \theta} - \frac{\cos \theta}{1 + \sin \theta} \equiv \tan \theta$. [4]

(ii) Solve the equation $\frac{1}{\cos \theta} - \frac{\cos \theta}{1 + \sin \theta} + 2 = 0$ for $0^\circ \leq \theta \leq 360^\circ$. [3]



7-12-12
6

(i) Show that the equation $2 \cos x = 3 \tan x$ can be written as a quadratic equation in $\sin x$. [3]

(ii) Solve the equation $2 \cos 2y = 3 \tan 2y$, for $0^\circ \leq y \leq 180^\circ$. [4]

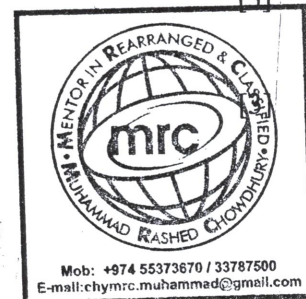
TRIGONOMETRY-Identity

5-11-12
5
17

(i) Prove the identity $\frac{\cos \theta}{\tan \theta(1 - \sin \theta)} \equiv 1 + \frac{1}{\sin \theta}$.

(ii) Hence solve the equation $\frac{\cos \theta}{\tan \theta(1 - \sin \theta)} = 4$, for $0^\circ \leq \theta \leq 360^\circ$.

[3]



7-14-13
5
18

(i) Show that $\sin^4 \theta - \cos^4 \theta \equiv 2 \sin^2 \theta - 1$.

[3]

(ii) Hence solve the equation $\sin^4 \theta - \cos^4 \theta = \frac{1}{2}$ for $0^\circ \leq \theta \leq 360^\circ$.

[4]

TRIGONOMETRY-Identity



Mob: +974 55373670 / 33787500
E-mail: chymrc.muhammad@gmail.com

57-14-13
4
19 (i) Prove the identity $\frac{\tan x + 1}{\sin x \tan x + \cos x} \equiv \sin x + \cos x$.

(ii) Hence solve the equation $\frac{\tan x + 1}{\sin x \tan x + \cos x} = 3 \sin x - 2 \cos x$ for $0 \leq x \leq 2\pi$.

8
2
20 (i) Show that the equation $2 \tan^2 \theta \cos \theta = 3$ can be written in the form $2 \cos^2 \theta + 3 \cos \theta - 2 = 0$. [2]

(ii) Hence solve the equation $2 \tan^2 \theta \cos \theta = 3$, for $0^\circ \leq \theta \leq 360^\circ$. [3]

TRIGONOMETRY-Solving

21 (i) Show that the equation $4 \sin^4 \theta + 5 = 7 \cos^2 \theta$ may be written in the form $4x^2 + 7x - 2 = 0$, where $x = \sin^2 \theta$. [1]

(ii) Hence solve the equation $4 \sin^4 \theta + 5 = 7 \cos^2 \theta$, for $0^\circ \leq \theta \leq 360^\circ$. [4]

22 (i) Show that the equation $\frac{4 \cos \theta}{\tan \theta} + 15 = 0$ can be expressed as

$$4 \sin^2 \theta - 15 \sin \theta - 4 = 0.$$

(ii) Hence solve the equation $\frac{4 \cos \theta}{\tan \theta} + 15 = 0$ for $0^\circ \leq \theta \leq 360^\circ$.



TRIGONOMETRY-Solving

23
5
3-13-N

(i) Show that $\frac{\sin \theta}{\sin \theta + \cos \theta} + \frac{\cos \theta}{\sin \theta - \cos \theta} \equiv \frac{1}{\sin^2 \theta - \cos^2 \theta}$.

(ii) Hence solve the equation $\frac{\sin \theta}{\sin \theta + \cos \theta} + \frac{\cos \theta}{\sin \theta - \cos \theta} = 3$, for $0^\circ \leq \theta \leq 360^\circ$.



24
4
3-10-13

(i) Show that the equation $2 \sin x \tan x + 3 = 0$ can be expressed as $2 \cos^2 x - 3 \cos x - 2 = 0$. [2]

(ii) Solve the equation $2 \sin x \tan x + 3 = 0$ for $0^\circ \leq x \leq 360^\circ$. [3]

TRIGONOMETRY-Solving

25

(i) Prove the identity $\frac{\sin \theta - \cos \theta}{\sin \theta + \cos \theta} \equiv \frac{\tan \theta - 1}{\tan \theta + 1}$.

(ii) Hence solve the equation $\frac{\sin \theta - \cos \theta}{\sin \theta + \cos \theta} = \frac{\tan \theta}{6}$, for $0^\circ \leq \theta \leq 180^\circ$.



20

(i) Show that the equation $2 \tan^2 \theta \sin^2 \theta = 1$ can be written in the form

$$2 \sin^4 \theta + \sin^2 \theta - 1 = 0.$$

[2]

(ii) Hence solve the equation $2 \tan^2 \theta \sin^2 \theta = 1$ for $0^\circ \leq \theta \leq 360^\circ$.

[4]

TRIGONOMETRY-Solving

7-13-12
5
27. It is given that $a = \sin \theta - 3 \cos \theta$ and $b = 3 \sin \theta + \cos \theta$, where $0^\circ \leq \theta \leq 360^\circ$.

(i) Show that $a^2 + b^2$ has a constant value for all values of θ .

(ii) Find the values of θ for which $2a = b$.



7-9-12
5
28 (i) Prove the identity $(\sin x + \cos x)(1 - \sin x \cos x) \equiv \sin^3 x + \cos^3 x$.

[3]

(ii) Solve the equation $(\sin x + \cos x)(1 - \sin x \cos x) = 9 \sin^3 x$ for $0^\circ \leq x \leq 360^\circ$.

[3]

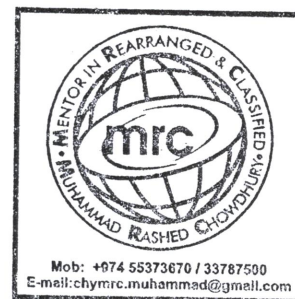
TRIGONOMETRY-Solving

- 29 (i) Show that the equation $3 \sin x \tan x = 8$ can be written as $3 \cos^2 x + 8 \cos x - 3 = 0$. [3]

(ii) Hence solve the equation $3 \sin x \tan x = 8$ for $0^\circ \leq x \leq 360^\circ$. [3]

- 30 (i) Prove the identity $\tan x + \frac{1}{\tan x} \equiv \frac{1}{\sin x \cos x}$. [2]

(ii) Solve the equation $\frac{2}{\sin x \cos x} = 1 + 3 \tan x$, for $0^\circ \leq x \leq 180^\circ$. [4]



TRIGONOMETRY-Solving

31

(i) Given that

$$3 \sin^2 x - 8 \cos x - 7 = 0,$$

show that, for real values of x ,

$$\cos x = -\frac{2}{3}.$$

(ii) Hence solve the equation

$$3 \sin^2(\theta + 70^\circ) - 8 \cos(\theta + 70^\circ) - 7 = 0$$

for $0^\circ \leq \theta \leq 180^\circ$.



[3]

[4]

TRIGONOMETRY

32 (i) Prove the identity $\frac{1 + \cos \theta}{\sin \theta} + \frac{\sin \theta}{1 + \cos \theta} \equiv \frac{2}{\sin \theta}$.

[3]



Q-17-11- T

(ii) Hence solve the equation $\frac{1 + \cos \theta}{\sin \theta} + \frac{\sin \theta}{1 + \cos \theta} = \frac{3}{\cos \theta}$ for $0^\circ \leq \theta \leq 360^\circ$.

[3]

Q-17-11- T-3

TRIGONOMETRY



33 (i) Prove the identity $\left(\frac{1}{\cos \theta} - \tan \theta\right)^2 \equiv \frac{1 - \sin \theta}{1 + \sin \theta}$. [3]

57-17-12-7

(ii) Hence solve the equation $\left(\frac{1}{\cos \theta} - \tan \theta\right)^2 = \frac{1}{2}$, for $0^\circ \leq \theta \leq 360^\circ$. [3]

17-12-7

TRIGONOMETRY-Solving

2-5-17

7 **34** Solve the equation $\sin^{-1}(4x^4 + x^2) = \frac{1}{6}\pi$.



2-5-17 **35** Find all the values of x in the interval $0^\circ \leq x \leq 180^\circ$ which satisfy the equation $\sin 3x + 2 \cos 3x = 0$. [4]

TRIGONOMETRY-Solving

2-14-11

36 Solve the equation $\frac{13 \sin^2 \theta}{2 + \cos \theta} + \cos \theta = 2$ for $0^\circ \leq \theta \leq 180^\circ$.



2-12-11

37 Solve the equation $\sin 2x = 2 \cos 2x$, for $0^\circ \leq x \leq 180^\circ$.

[4]

TRIGONOMETRY-Solving

5-12-13

3 38 Solve the equation $7 \cos x + 5 = 2 \sin^2 x$, for $0^\circ \leq x \leq 360^\circ$.



10-13

3 39 Solve the equation $15 \sin^2 x = 13 + \cos x$ for $0^\circ \leq x \leq 180^\circ$.

[4]

TRIGONOMETRY-Solving



5-12-13

40 (i) Solve the equation $\sin 2x + 3 \cos 2x = 0$ for $0^\circ \leq x \leq 360^\circ$.

(ii) How many solutions has the equation $\sin 2x + 3 \cos 2x = 0$ for $0^\circ \leq x \leq 1080^\circ$?

12

5-16-13

41 (ii) Find the solutions to the equation $3 \sin 2x \tan 2x - \cos 2x + 1 = 0$ for $0 \leq x \leq \pi$.

[3]