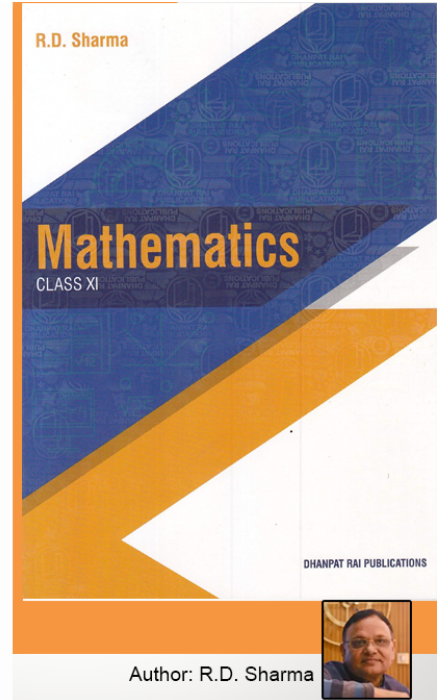


Class 11 - Chapter 8 Transformation Formulae



RD Sharma Solutions for Class 11 Maths Chapter 8–Transformation Formulae

Class 11: Maths Chapter 8 solutions. Complete Class 11 Maths Chapter 8 Notes.

RD Sharma Solutions for Class 11 Maths Chapter 8–Transformation Formulae

RD Sharma 11th Maths Chapter 8, Class 11 Maths Chapter 8 solutions

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>



EXERCISE 8.1 PAGE NO: 8.6

1. Express each of the following as the sum or difference of sines and cosines:

(i) $2 \sin 3x \cos x$

(ii) $2 \cos 3x \sin 2x$

(iii) $2 \sin 4x \sin 3x$

(iv) $2 \cos 7x \cos 3x$

Solution:

(i) $2 \sin 3x \cos x$

By using the formula,

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

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

$$= \sin (4x) + \sin (2x)$$

$$= \sin 4x + \sin 2x$$

(ii) $2 \cos 3x \sin 2x$

By using the formula,

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

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

$$= \sin (5x) - \sin (x)$$

$$= \sin 5x - \sin x$$

(iii) $2 \sin 4x \sin 3x$

By using the formula,

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

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$2 \sin 4x \sin 3x = \cos (4x - 3x) - \cos (4x + 3x)$$

$$= \cos (x) - \cos (7x)$$

$$= \cos x - \cos 7x$$

(iv) $2 \cos 7x \cos 3x$

By using the formula,

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

$$2 \sin 3x \cos x = \cos (7x + 3x) + \cos (7x - 3x)$$

$$= \cos (10x) + \cos (4x)$$

$$= \cos 10x + \cos 4x$$

2. Prove that:

(i) $2 \sin 5\pi/12 \sin \pi/12 = 1/2$

(ii) $2 \cos 5\pi/12 \cos \pi/12 = 1/2$

(iii) $2 \sin 5\pi/12 \cos \pi/12 = (\sqrt{3} + 2)/2$

Solution:

(i) $2 \sin 5\pi/12 \sin \pi/12 = 1/2$

By using the formula,

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

$$2 \sin 5\pi/12 \sin \pi/12 = \cos (5\pi/12 - \pi/12) - \cos (5\pi/12 + \pi/12)$$

$$= \cos (4\pi/12) - \cos (6\pi/12)$$

$$= \cos (\pi/3) - \cos (\pi/2)$$

$$= \cos (180^\circ/3) - \cos (180^\circ/2)$$

$$= \cos 60^\circ - \cos 90^\circ$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 1/2 - 0$$

$$= 1/2$$

Hence Proved.

$$(ii) 2 \cos 5\pi/12 \cos \pi/12 = 1/2$$

By using the formula,

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

$$2 \cos 5\pi/12 \cos \pi/12 = \cos (5\pi/12 + \pi/12) + \cos (5\pi/12 - \pi/12)$$

$$= \cos (6\pi/12) + \cos (4\pi/12)$$

$$= \cos (\pi/2) + \cos (\pi/3)$$

$$= \cos (180^\circ/2) + \cos (180^\circ/3)$$

$$= \cos 90^\circ + \cos 60^\circ$$

$$= 0 + 1/2$$

$$= 1/2$$

Hence Proved.

$$(iii) 2 \sin 5\pi/12 \cos \pi/12 = (\sqrt{3} + 2)/2$$

By using the formula,

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

$$2 \sin 5\pi/12 \cos \pi/12 = \sin (5\pi/12 + \pi/12) + \sin (5\pi/12 - \pi/12)$$

$$= \sin (6\pi/12) + \sin (4\pi/12)$$

$$= \sin (\pi/2) + \sin (\pi/3)$$

$$= \sin (180^\circ/2) + \sin (180^\circ/3)$$

$$= \sin 90^\circ + \sin 60^\circ$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 1 + \sqrt{3}$$

$$= (2 + \sqrt{3})/2$$

$$= (\sqrt{3} + 2)/2$$

Hence Proved.

3. show that:

(i) $\sin 50^\circ \cos 85^\circ = (1 - \sqrt{2}\sin 35^\circ)/2\sqrt{2}$

(ii) $\sin 25^\circ \cos 115^\circ = 1/2 \{\sin 140^\circ - 1\}$

Solution:

(i) $\sin 50^\circ \cos 85^\circ = (1 - \sqrt{2}\sin 35^\circ)/2\sqrt{2}$

By using the formula,

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

$$\sin A \cos B = [\sin (A + B) + \sin (A - B)] / 2$$

$$\sin 50^\circ \cos 85^\circ = [\sin(50^\circ + 85^\circ) + \sin (50^\circ - 85^\circ)] / 2$$

$$= [\sin (135^\circ) + \sin (-35^\circ)] / 2$$

$$= [\sin (135^\circ) - \sin (35^\circ)] / 2 \text{ (since, } \sin (-x) = -\sin x)$$

$$= [\sin (180^\circ - 45^\circ) - \sin 35^\circ] / 2$$

$$= [\sin 45^\circ - \sin 35^\circ] / 2$$

$$= [(1/\sqrt{2}) - \sin 35^\circ] / 2$$

$$= [(1 - \sin 35^\circ)/\sqrt{2}] / 2$$

$$= (1 - \sin 35^\circ) / 2\sqrt{2}$$

Hence proved.

(ii) $\sin 25^\circ \cos 115^\circ = 1/2 \{\sin 140^\circ - 1\}$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

By using the formula,

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

$$\sin A \cos B = [\sin (A + B) + \sin (A - B)] / 2$$

$$\sin 20^\circ \cos 115^\circ = [\sin(25^\circ + 115^\circ) + \sin (25^\circ - 115^\circ)] / 2$$

$$= [\sin (140^\circ) + \sin (-90^\circ)] / 2$$

$$= [\sin (140^\circ) - \sin (90^\circ)] / 2 \text{ (since, } \sin (-x) = -\sin x)$$

$$= 1/2 \{\sin 140^\circ - 1\}$$

Hence proved.

4. Prove that:

$$4 \cos x \cos (\pi/3 + x) \cos (\pi/3 - x) = \cos 3x$$

Solution:

Let us consider LHS:

$$4 \cos x \cos (\pi/3 + x) \cos (\pi/3 - x) = 2 \cos x (2 \cos (\pi/3 + x) \cos (\pi/3 - x))$$

By using the formula,

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

$$2 \cos x (2 \cos (\pi/3+x) \cos (\pi/3 - x)) = 2 \cos x (\cos (\pi/3+x + \pi/3-x) + \cos (\pi/3+x - \pi/3+ x))$$

$$= 2 \cos x (\cos (2\pi/3) + \cos (2x))$$

$$= 2 \cos x \{\cos 120^\circ + \cos 2x\}$$

$$= 2 \cos x \{\cos (180^\circ - 60^\circ) + \cos 2x\}$$

$$= 2 \cos x (\cos 2x - \cos 60^\circ) \text{ (since, } \{\cos (180^\circ - A) = -\cos A\})$$

$$= 2 \cos 2x \cos x - 2 \cos x \cos 60^\circ$$

$$= (\cos (x + 2x) + \cos (2x - x)) - (2\cos x)/2$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= \cos 3x + \cos x - \cos x$$

$$= \cos 3x$$

$$= \text{RHS}$$

Hence Proved.

EXERCISE 8.2 PAGE NO: 8.17

1. Express each of the following as the product of sines and cosines:

(i) $\sin 12x + \sin 4x$

(ii) $\sin 5x - \sin x$

(iii) $\cos 12x + \cos 8x$

(iv) $\cos 12x - \cos 4x$

(v) $\sin 2x + \cos 4x$

Solution:

(i) $\sin 12x + \sin 4x$

By using the formula,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\sin 12x + \sin 4x = 2 \sin \frac{(12x + 4x)}{2} \cos \frac{(12x - 4x)}{2}$$

$$= 2 \sin 16x/2 \cos 8x/2$$

$$= 2 \sin 8x \cos 4x$$

(ii) $\sin 5x - \sin x$

By using the formula,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\sin 5x - \sin x = 2 \cos \frac{(5x + x)}{2} \sin \frac{(5x - x)}{2}$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 2 \cos 6x/2 \sin 4x/2$$

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

(iii) $\cos 12x + \cos 8x$

By using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$\cos 12x + \cos 8x = 2 \cos (12x + 8x)/2 \cos (12x - 8x)/2$$

$$= 2 \cos 20x/2 \cos 4x/2$$

$$= 2 \cos 10x \cos 2x$$

(iv) $\cos 12x - \cos 4x$

By using the formula,

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

$$\cos 12x - \cos 4x = -2 \sin (12x + 4x)/2 \sin (12x - 4x)/2$$

$$= -2 \sin 16x/2 \sin 8x/2$$

$$= -2 \sin 8x \sin 4x$$

(v) $\sin 2x + \cos 4x$

$$\sin 2x + \cos 4x = \sin 2x + \sin (90^\circ - 4x)$$

By using the formula,

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

$$\sin 2x + \sin (90^\circ - 4x) = 2 \sin (2x + 90^\circ - 4x)/2 \cos (2x - 90^\circ + 4x)/2$$

$$= 2 \sin (90^\circ - 2x)/2 \cos (6x - 90^\circ)/2$$

$$= 2 \sin (45^\circ - x) \cos (3x - 45^\circ)$$

$$= 2 \sin (45^\circ - x) \cos \{-(45^\circ - 3x)\} \text{ (since, } \{\cos (-x) = \cos x\})$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 2 \sin (45^\circ - x) \cos (45^\circ - 3x)$$

$$= 2 \sin (\pi/4 - x) \cos (\pi/4 - 3x)$$

2. Prove that :

(i) $\sin 38^\circ + \sin 22^\circ = \sin 82^\circ$

(ii) $\cos 100^\circ + \cos 20^\circ = \cos 40^\circ$

(iii) $\sin 50^\circ + \sin 10^\circ = \cos 20^\circ$

(iv) $\sin 23^\circ + \sin 37^\circ = \cos 7^\circ$

(v) $\sin 105^\circ + \cos 105^\circ = \cos 45^\circ$

(vi) $\sin 40^\circ + \sin 20^\circ = \cos 10^\circ$

Solution:

(i) $\sin 38^\circ + \sin 22^\circ = \sin 82^\circ$

Let us consider LHS:

$$\sin 38^\circ + \sin 22^\circ$$

By using the formula,

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

$$\sin 38^\circ + \sin 22^\circ = 2 \sin (38^\circ + 22^\circ)/2 \cos (38^\circ - 22^\circ)/2$$

$$= 2 \sin 60^\circ/2 \cos 16^\circ/2$$

$$= 2 \sin 30^\circ \cos 8^\circ$$

$$= 2 \times 1/2 \times \cos 8^\circ$$

$$= \cos 8^\circ$$

$$= \cos (90^\circ - 82^\circ)$$

$$= \sin 82^\circ \text{ (since, } \{\cos (90^\circ - A) = \sin A\})$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

= RHS

Hence Proved.

(ii) $\cos 100^\circ + \cos 20^\circ = \cos 40^\circ$

Let us consider LHS:

$$\cos 100^\circ + \cos 20^\circ$$

By using the formula,

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\cos 100^\circ + \cos 20^\circ = 2 \cos \frac{(100^\circ + 20^\circ)}{2} \cos \frac{(100^\circ - 20^\circ)}{2}$$

$$= 2 \cos 120^\circ/2 \cos 80^\circ/2$$

$$= 2 \cos 60^\circ \cos 4^\circ$$

$$= 2 \times \frac{1}{2} \times \cos 40^\circ$$

$$= \cos 40^\circ$$

= RHS

Hence Proved.

(iii) $\sin 50^\circ + \sin 10^\circ = \cos 20^\circ$

Let us consider LHS:

$$\sin 50^\circ + \sin 10^\circ$$

By using the formula,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\sin 50^\circ + \sin 10^\circ = 2 \sin \frac{(50^\circ + 10^\circ)}{2} \cos \frac{(50^\circ - 10^\circ)}{2}$$

$$= 2 \sin 60^\circ/2 \cos 40^\circ/2$$

$$= 2 \sin 30^\circ \cos 20^\circ$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 2 \times \frac{1}{2} \times \cos 20^\circ$$

$$= \cos 20^\circ$$

$$= \text{RHS}$$

Hence Proved.

$$\text{(iv)} \sin 23^\circ + \sin 37^\circ = \cos 7^\circ$$

Let us consider LHS:

$$\sin 23^\circ + \sin 37^\circ$$

By using the formula,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\sin 23^\circ + \sin 37^\circ = 2 \sin \frac{(23^\circ + 37^\circ)}{2} \cos \frac{(23^\circ - 37^\circ)}{2}$$

$$= 2 \sin 60^\circ/2 \cos -14^\circ/2$$

$$= 2 \sin 30^\circ \cos -7^\circ$$

$$= 2 \times \frac{1}{2} \times \cos -7^\circ$$

$$= \cos 7^\circ \text{ (since, } \{\cos (-A) = \cos A\})$$

$$= \text{RHS}$$

Hence Proved.

$$\text{(v)} \sin 105^\circ + \cos 105^\circ = \cos 45^\circ$$

Let us consider LHS: $\sin 105^\circ + \cos 105^\circ$

$$\sin 105^\circ + \cos 105^\circ = \sin 105^\circ + \sin (90^\circ - 105^\circ) \text{ [since, } \{\sin (90^\circ - A) = \cos A\}]$$

$$= \sin 105^\circ + \sin (-15^\circ)$$

$$= \sin 105^\circ - \sin 15^\circ \text{ [}\{\sin(-A) = -\sin A\}\text{]}$$

By using the formula,

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

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

$$\sin 105^\circ - \sin 15^\circ = 2 \cos (105^\circ + 15^\circ)/2 \sin (105^\circ - 15^\circ)/2$$

$$= 2 \cos 120^\circ/2 \sin 90^\circ/2$$

$$= 2 \cos 60^\circ \sin 45^\circ$$

$$= 2 \times 1/2 \times 1/\sqrt{2}$$

$$= 1/\sqrt{2}$$

$$= \cos 45^\circ$$

$$= \text{RHS}$$

Hence proved.

$$\text{(vi)} \sin 40^\circ + \sin 20^\circ = \cos 10^\circ$$

Let us consider LHS:

$$\sin 40^\circ + \sin 20^\circ$$

By using the formula,

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

$$\sin 40^\circ + \sin 20^\circ = 2 \sin (40^\circ + 20^\circ)/2 \cos (40^\circ - 20^\circ)/2$$

$$= 2 \sin 60^\circ/2 \cos 20^\circ/2$$

$$= 2 \sin 30^\circ \cos 10^\circ$$

$$= 2 \times 1/2 \times \cos 10^\circ$$

$$= \cos 10^\circ$$

$$= \text{RHS}$$

Hence Proved.

3. Prove that:

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

(i) $\cos 55^\circ + \cos 65^\circ + \cos 175^\circ = 0$

(ii) $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ = 0$

(iii) $\cos 80^\circ + \cos 40^\circ - \cos 20^\circ = 0$

(iv) $\cos 20^\circ + \cos 100^\circ + \cos 140^\circ = 0$

(v) $\sin 5\pi/18 - \cos 4\pi/9 = \sqrt{3} \sin \pi/9$

(vi) $\cos \pi/12 - \sin \pi/12 = 1/\sqrt{2}$

(vii) $\sin 80^\circ - \cos 70^\circ = \cos 50^\circ$

(viii) $\sin 51^\circ + \cos 81^\circ = \cos 21^\circ$

Solution:

(i) $\cos 55^\circ + \cos 65^\circ + \cos 175^\circ = 0$

Let us consider LHS:

$$\cos 55^\circ + \cos 65^\circ + \cos 175^\circ$$

By using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$\cos 55^\circ + \cos 65^\circ + \cos 175^\circ = 2 \cos (55^\circ + 65^\circ)/2 \cos (55^\circ - 65^\circ) + \cos (180^\circ - 5^\circ)$$

$$= 2 \cos 120^\circ/2 \cos (-10^\circ)/2 - \cos 5^\circ \text{ (since, } \{\cos (180^\circ - A) = -\cos A\})$$

$$= 2 \cos 60^\circ \cos (-5^\circ) - \cos 5^\circ \text{ (since, } \{\cos (-A) = \cos A\})$$

$$= 2 \times 1/2 \times \cos 5^\circ - \cos 5^\circ$$

$$= 0$$

$$= \text{RHS}$$

Hence Proved.

(ii) $\sin 50^\circ - \sin 70^\circ + \sin 10^\circ = 0$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

Let us consider LHS:

$$\sin 50^\circ - \sin 70^\circ + \sin 10^\circ$$

By using the formula,

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

$$\sin 50^\circ - \sin 70^\circ + \sin 10^\circ = 2 \cos (50^\circ + 70^\circ)/2 \sin (50^\circ - 70^\circ) + \sin 10^\circ$$

$$= 2 \cos 120^\circ/2 \sin (-20^\circ)/2 + \sin 10^\circ$$

$$= 2 \cos 60^\circ (-\sin 10^\circ) + \sin 10^\circ \text{ [since, } \{\sin (-A) = -\sin (A)\}]$$

$$= 2 \times 1/2 \times -\sin 10^\circ + \sin 10^\circ$$

$$= 0$$

$$= \text{RHS}$$

Hence proved.

$$\text{(iii) } \cos 80^\circ + \cos 40^\circ - \cos 20^\circ = 0$$

Let us consider LHS:

$$\cos 80^\circ + \cos 40^\circ - \cos 20^\circ$$

By using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$\cos 80^\circ + \cos 40^\circ - \cos 20^\circ = 2 \cos (80^\circ + 40^\circ)/2 \cos (80^\circ - 40^\circ) - \cos 20^\circ$$

$$= 2 \cos 120^\circ/2 \cos 40^\circ/2 - \cos 20^\circ$$

$$= 2 \cos 60^\circ \cos 20^\circ - \cos 20^\circ$$

$$= 2 \times 1/2 \times \cos 20^\circ - \cos 20^\circ$$

$$= 0$$

$$= \text{RHS}$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

Hence Proved.

$$(iv) \cos 20^\circ + \cos 100^\circ + \cos 140^\circ = 0$$

Let us consider LHS:

$$\cos 20^\circ + \cos 100^\circ + \cos 140^\circ$$

By using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$\cos 20^\circ + \cos 100^\circ + \cos 140^\circ = 2 \cos (20^\circ + 100^\circ)/2 \cos (20^\circ - 100^\circ) + \cos (180^\circ - 40^\circ)$$

$$= 2 \cos 120^\circ/2 \cos (-80^\circ)/2 - \cos 40^\circ \text{ (since, } \{\cos (180^\circ - A) = -\cos A\})$$

$$= 2 \cos 60^\circ \cos (-40^\circ) - \cos 40^\circ \text{ (since, } \{\cos (-A) = \cos A\})$$

$$= 2 \times 1/2 \times \cos 40^\circ - \cos 40^\circ$$

$$= 0$$

$$= \text{RHS}$$

Hence Proved.

$$(v) \sin 5\pi/18 - \cos 4\pi/9 = \sqrt{3} \sin \pi/9$$

Let us consider LHS:

$$\sin 5\pi/18 - \cos 4\pi/9 = \sin 5\pi/18 - \sin (\pi/2 - 4\pi/9) \text{ (since, } \cos A = \sin (90^\circ - A))$$

$$= \sin 5\pi/18 - \sin (9\pi - 8\pi)/18$$

$$= \sin 5\pi/18 - \sin \pi/18$$

By using the formula,

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

$$\sin \frac{5\pi}{18} - \sin \frac{\pi}{18} = 2 \cos \left(\frac{\frac{5\pi}{18} + \frac{\pi}{18}}{2} \right) \sin \left(\frac{\frac{5\pi}{18} - \frac{\pi}{18}}{2} \right)$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 2 \cos (6\pi/36) \sin (4\pi/36)$$

$$= 2 \cos \pi/6 \sin \pi/9$$

$$= 2 \cos 30^\circ \sin \pi/9$$

$$= 2 \times \sqrt{3}/2 \times \sin \pi/9$$

$$= \sqrt{3} \sin \pi/9$$

$$= \text{RHS}$$

Hence proved.

$$\text{(vi)} \cos \pi/12 - \sin \pi/12 = 1/\sqrt{2}$$

Let us consider LHS:

$$\cos \pi/12 - \sin \pi/12 = \sin (\pi/2 - \pi/12) - \sin \pi/12 \text{ (since, } \cos A = \sin(90^\circ - A)\text{)}$$

$$= \sin (6\pi - 5\pi)/12 - \sin \pi/12$$

$$= \sin 5\pi/12 - \sin \pi/12$$

By using the formula,

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

$$\sin \frac{5\pi}{12} - \sin \frac{\pi}{12} = 2 \cos \left(\frac{\frac{5\pi}{12} + \frac{\pi}{12}}{2} \right) \sin \left(\frac{\frac{5\pi}{12} - \frac{\pi}{12}}{2} \right)$$

$$= 2 \cos (6\pi/24) \sin (4\pi/24)$$

$$= 2 \cos \pi/4 \sin \pi/6$$

$$= 2 \cos 45^\circ \sin 30^\circ$$

$$= 2 \times 1/\sqrt{2} \times 1/2$$

$$= 1/\sqrt{2}$$

$$= \text{RHS}$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

Hence proved.

$$(vii) \sin 80^\circ - \cos 70^\circ = \cos 50^\circ$$

$$\sin 80^\circ = \cos 50^\circ + \cos 70^\circ$$

So, now let us consider RHS

$$\cos 50^\circ + \cos 70^\circ$$

By using the formula,

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\cos 50^\circ + \cos 70^\circ = 2 \cos \frac{(50^\circ + 70^\circ)}{2} \cos \frac{(50^\circ - 70^\circ)}{2}$$

$$= 2 \cos 120^\circ/2 \cos (-20^\circ)/2$$

$$= 2 \cos 60^\circ \cos (-10^\circ)$$

$$= 2 \times \frac{1}{2} \times \cos 10^\circ \text{ (since, } \cos (-A) = \cos A \text{)}$$

$$= \cos 10^\circ$$

$$= \cos (90^\circ - 80^\circ)$$

$$= \sin 80^\circ \text{ (since, } \cos (90^\circ - A) = \sin A \text{)}$$

$$= \text{LHS}$$

Hence Proved.

$$(viii) \sin 51^\circ + \cos 81^\circ = \cos 21^\circ$$

Let us consider LHS:

$$\sin 51^\circ + \cos 81^\circ = \sin 51^\circ + \sin (90^\circ - 81^\circ)$$

$$= \sin 51^\circ + \sin 9^\circ \text{ (since, } \sin (90^\circ - A) = \cos A \text{)}$$

By using the formula,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$\sin 51^\circ + \sin 9^\circ = 2 \sin (51^\circ + 9^\circ)/2 \cos (51^\circ - 9^\circ)/2$$

$$= 2 \sin 60^\circ/2 \cos 42^\circ/2$$

$$= 2 \sin 30^\circ \cos 21^\circ$$

$$= 2 \times 1/2 \times \cos 21^\circ$$

$$= \cos 21^\circ$$

$$= \text{RHS}$$

Hence proved.

4. Prove that:

$$(i) \cos (3\pi/4 + x) - \cos (3\pi/4 - x) = -\sqrt{2} \sin x$$

$$(ii) \cos (\pi/4 + x) + \cos (\pi/4 - x) = \sqrt{2} \cos x$$

Solution:

$$(i) \cos (3\pi/4 + x) - \cos (3\pi/4 - x) = -\sqrt{2} \sin x$$

Let us consider LHS:

$$\cos (3\pi/4 + x) - \cos (3\pi/4 - x)$$

By using the formula,

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

$$\cos (3\pi/4 + x) - \cos (3\pi/4 - x) = -2 \sin (3\pi/4 + x + 3\pi/4 - x)/2 \sin (3\pi/4 + x - 3\pi/4 - x)/2$$

$$= -2 \sin (6\pi/4)/2 \sin 2x/2$$

$$= -2 \sin 6\pi/8 \sin x$$

$$= -2 \sin 3\pi/4 \sin x$$

$$= -2 \sin (\pi - \pi/4) \sin x$$

$$= -2 \sin \pi/4 \sin x \text{ (since, } (\pi - A) = \sin A)$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= -2 \times 1/\sqrt{2} \times \sin x$$

$$= -\sqrt{2} \sin x$$

$$= \text{RHS}$$

Hence proved.

$$\text{(ii)} \cos (\pi/4 + x) + \cos (\pi/4 - x) = \sqrt{2} \cos x$$

Let us consider LHS:

$$\cos (\pi/4 + x) + \cos (\pi/4 - x)$$

By using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$\cos (\pi/4 + x) + \cos (\pi/4 - x) = 2 \cos (\pi/4 + x + \pi/4 - x)/2 \cos (\pi/4 + x - \pi/4 + x)/2$$

$$= 2 \cos (2\pi/4)/2 \cos 2x/2$$

$$= 2 \cos 2\pi/8 \cos x$$

$$= 2 \sin \pi/4 \cos x$$

$$= 2 \times 1/\sqrt{2} \times \cos x$$

$$= \sqrt{2} \cos x$$

$$= \text{RHS}$$

Hence proved.

5. Prove that:

$$\text{(i)} \sin 65^\circ + \cos 65^\circ = \sqrt{2} \cos 20^\circ$$

$$\text{(ii)} \sin 47^\circ + \cos 77^\circ = \cos 17^\circ$$

Solution:

$$\text{(i)} \sin 65^\circ + \cos 65^\circ = \sqrt{2} \cos 20^\circ$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

Let us consider LHS:

$$\sin 65^\circ + \cos 65^\circ = \sin 65^\circ + \sin (90^\circ - 65^\circ)$$

$$= \sin 65^\circ + \sin 25^\circ$$

By using the formula,

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

$$\sin 65^\circ + \sin 25^\circ = 2 \sin (65^\circ + 25^\circ)/2 \cos (65^\circ - 25^\circ)/2$$

$$= 2 \sin 90^\circ/2 \cos 40^\circ/2$$

$$= 2 \sin 45^\circ \cos 20^\circ$$

$$= 2 \times 1/\sqrt{2} \times \cos 20^\circ$$

$$= \sqrt{2} \cos 20^\circ$$

$$= \text{RHS}$$

Hence proved.

$$\text{(ii) } \sin 47^\circ + \cos 77^\circ = \cos 17^\circ$$

Let us consider LHS:

$$\sin 47^\circ + \cos 77^\circ = \sin 47^\circ + \sin (90^\circ - 77^\circ)$$

$$= \sin 47^\circ + \sin 13^\circ$$

By using the formula,

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

$$\sin 47^\circ + \sin 13^\circ = 2 \sin (47^\circ + 13^\circ)/2 \cos (47^\circ - 13^\circ)/2$$

$$= 2 \sin 60^\circ/2 \cos 34^\circ/2$$

$$= 2 \sin 30^\circ \cos 17^\circ$$

$$= 2 \times 1/2 \times \cos 17^\circ$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= \cos 17^\circ$$

$$= \text{RHS}$$

Hence proved.

6. Prove that:

$$(i) \cos 3A + \cos 5A + \cos 7A + \cos 15A = 4 \cos 4A \cos 5A \cos 6A$$

$$(ii) \cos A + \cos 3A + \cos 5A + \cos 7A = 4 \cos A \cos 2A \cos 4A$$

$$(iii) \sin A + \sin 2A + \sin 4A + \sin 5A = 4 \cos A/2 \cos 3A/2 \sin 3A$$

$$(iv) \sin 3A + \sin 2A - \sin A = 4 \sin A \cos A/2 \cos 3A/2$$

$$(v) \cos 20^\circ \cos 100^\circ + \cos 100^\circ \cos 140^\circ - \cos 140^\circ \cos 200^\circ = -3/4$$

$$(vi) \sin x/2 \sin 7x/2 + \sin 3x/2 \sin 11x/2 = \sin 2x \sin 5x$$

$$(vii) \cos x \cos x/2 - \cos 3x \cos 9x/2 = \sin 4x \sin 7x/2$$

Solution:

$$(i) \cos 3A + \cos 5A + \cos 7A + \cos 15A = 4 \cos 4A \cos 5A \cos 6A$$

Let us consider LHS:

$$\cos 3A + \cos 5A + \cos 7A + \cos 15A$$

So now,

$$(\cos 5A + \cos 3A) + (\cos 15A + \cos 7A)$$

By using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$(\cos 5A + \cos 3A) + (\cos 15A + \cos 7A)$$

$$= [2 \cos (5A+3A)/2 \cos (5A-3A)/2] + [2 \cos (15A+7A)/2 \cos (15A-7A)/2]$$

$$= [2 \cos 8A/2 \cos 2A/2] + [2 \cos 22A/2 \cos 8A/2]$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= [2 \cos 4A \cos A] + [2 \cos 11A \cos 4A]$$

$$= 2 \cos 4A (\cos 11A + \cos A)$$

Again by using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$2 \cos 4A (\cos 11A + \cos A) = 2 \cos 4A [2 \cos (11A+A)/2 \cos (11A-A)/2]$$

$$= 2 \cos 4A [2 \cos 12A/2 \cos 10A/2]$$

$$= 2 \cos 4A [2 \cos 6A \cos 5A]$$

$$= 4 \cos 4A \cos 5A \cos 6A$$

$$= \text{RHS}$$

Hence proved.

$$(ii) \cos A + \cos 3A + \cos 5A + \cos 7A = 4 \cos A \cos 2A \cos 4A$$

Let us consider LHS:

$$\cos A + \cos 3A + \cos 5A + \cos 7A$$

So now,

$$(\cos 3A + \cos A) + (\cos 7A + \cos 5A)$$

By using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$(\cos 3A + \cos A) + (\cos 7A + \cos 5A)$$

$$= [2 \cos (3A+A)/2 \cos (3A-A)/2] + [2 \cos (7A+5A)/2 \cos (7A-5A)/2]$$

$$= [2 \cos 4A/2 \cos 2A/2] + [2 \cos 12A/2 \cos 2A/2]$$

$$= [2 \cos 2A \cos A] + [2 \cos 6A \cos A]$$

$$= 2 \cos A (\cos 6A + \cos 2A)$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

Again by using the formula,

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$2 \cos A (\cos 6A + \cos 2A) = 2 \cos A [2 \cos \frac{(6A+2A)}{2} \cos \frac{(6A-2A)}{2}]$$

$$= 2 \cos A [2 \cos 8A/2 \cos 4A/2]$$

$$= 2 \cos A [2 \cos 4A \cos 2A]$$

$$= 4 \cos A \cos 2A \cos 4A$$

$$= \text{RHS}$$

Hence proved.

$$\text{(iii)} \sin A + \sin 2A + \sin 4A + \sin 5A = 4 \cos A/2 \cos 3A/2 \sin 3A$$

Let us consider LHS:

$$\sin A + \sin 2A + \sin 4A + \sin 5A$$

So now,

$$(\sin 2A + \sin A) + (\sin 5A + \sin 4A)$$

By using the formula,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$(\sin 2A + \sin A) + (\sin 5A + \sin 4A) =$$

$$= [2 \sin \frac{(2A+A)}{2} \cos \frac{(2A-A)}{2}] + [2 \sin \frac{(5A+4A)}{2} \cos \frac{(5A-4A)}{2}]$$

$$= [2 \sin 3A/2 \cos A/2] + [2 \sin 9A/2 \cos A/2]$$

$$= 2 \cos A/2 (\sin 9A/2 + \sin 3A/2)$$

Again by using the formula,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$2 \cos A/2 (\sin 9A/2 + \sin 3A/2) = 2 \cos A/2 [2 \sin \frac{(9A/2 + 3A/2)}{2} \cos \frac{(9A/2 - 3A/2)}{2}]$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 2 \cos A/2 [2 \sin ((9A+3A)/2)/2 \cos ((9A-3A)/2)/2]$$

$$= 2 \cos A/2 [2 \sin 12A/4 \cos 6A/4]$$

$$= 2 \cos A/2 [2 \sin 3A \cos 3A/2]$$

$$= 4 \cos A/2 \cos 3A/2 \sin 3A$$

$$= \text{RHS}$$

Hence proved.

$$\text{(iv) } \sin 3A + \sin 2A - \sin A = 4 \sin A \cos A/2 \cos 3A/2$$

Let us consider LHS:

$$\sin 3A + \sin 2A - \sin A$$

So now,

$$(\sin 3A - \sin A) + \sin 2A$$

By using the formula,

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

$$(\sin 3A - \sin A) + \sin 2A = 2 \cos (3A + A)/2 \sin (3A - A)/2 + \sin 2A$$

$$= 2 \cos 4A/2 \sin 2A/2 + \sin 2A$$

We know that, $\sin 2A = 2 \sin A \cos A$

$$= 2 \cos 2A \sin A + 2 \sin A \cos A$$

$$= 2 \sin A (\cos 2A + \cos A)$$

Again by using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$2 \sin A (\cos 2A + \cos A) = 2 \sin A [2 \cos (2A+A)/2 \cos (2A-A)/2]$$

$$= 2 \sin A [2 \cos 3A/2 \cos A/2]$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 4 \sin A \cos A/2 \cos 3A/2$$

$$= \text{RHS}$$

Hence proved.

$$(v) \cos 20^\circ \cos 100^\circ + \cos 100^\circ \cos 140^\circ - \cos 140^\circ \cos 200^\circ = -3/4$$

Let us consider LHS:

$$\cos 20^\circ \cos 100^\circ + \cos 100^\circ \cos 140^\circ - \cos 140^\circ \cos 200^\circ =$$

We shall multiply and divide by 2 we get,

$$= 1/2 [2 \cos 100^\circ \cos 20^\circ + 2 \cos 140^\circ \cos 100^\circ - 2 \cos 200^\circ \cos 140^\circ]$$

$$\text{We know that } 2 \cos A \cos B = \cos (A+B) + \cos (A-B)$$

So,

$$= 1/2 [\cos (100^\circ + 20^\circ) + \cos (100^\circ - 20^\circ) + \cos (140^\circ + 100^\circ) + \cos (140^\circ - 100^\circ) - \cos (200^\circ + 140^\circ) - \cos (200^\circ - 140^\circ)]$$

$$= 1/2 [\cos 120^\circ + \cos 80^\circ + \cos 240^\circ + \cos 40^\circ - \cos 340^\circ - \cos 60^\circ]$$

$$= 1/2 [\cos (90^\circ + 30^\circ) + \cos 80^\circ + \cos (180^\circ + 60^\circ) + \cos 40^\circ - \cos (360^\circ - 20^\circ) - \cos 60^\circ]$$

$$\text{We know, } \cos (180^\circ + A) = -\cos A, \cos (90^\circ + A) = -\sin A, \cos (360^\circ - A) = \cos A$$

So,

$$= 1/2 [-\sin 30^\circ + \cos 80^\circ - \cos 60^\circ + \cos 40^\circ - \cos 20^\circ - \cos 60^\circ]$$

$$= 1/2 [-\sin 30^\circ + \cos 80^\circ + \cos 40^\circ - \cos 20^\circ - 2 \cos 60^\circ]$$

Again by using the formula,

$$\cos A + \cos B = 2 \cos (A+B)/2 \cos (A-B)/2$$

$$= 1/2 [-\sin 30^\circ + 2 \cos (80^\circ + 40^\circ)/2 \cos (80^\circ - 40^\circ)/2 - \cos 20^\circ - 2 \times 1/2]$$

$$= 1/2 [-\sin 30^\circ + 2 \cos 120^\circ/2 \cos 40^\circ/2 - \cos 20^\circ - 1]$$

$$= 1/2 [-\sin 30^\circ + 2 \cos 60^\circ \cos 20^\circ - \cos 20^\circ - 1]$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= 1/2 [-1/2 + 2 \times 1/2 \times \cos 20^\circ - \cos 20^\circ - 1]$$

$$= 1/2 [-1/2 + \cos 20^\circ - \cos 20^\circ - 1]$$

$$= 1/2 [-1/2 - 1]$$

$$= 1/2 [-3/2]$$

$$= -3/4$$

$$= \text{RHS}$$

Hence proved.

$$\text{(vi)} \sin x/2 \sin 7x/2 + \sin 3x/2 \sin 11x/2 = \sin 2x \sin 5x$$

Let us consider LHS:

$$\sin x/2 \sin 7x/2 + \sin 3x/2 \sin 11x/2 =$$

We shall multiply and divide by 2 we get,

$$= 1/2 [2 \sin 7x/2 \sin x/2 + 2 \sin 11x/2 \sin 3x/2]$$

$$\text{We know that } 2 \sin A \sin B = \cos (A-B) - \cos (A+B)$$

So,

$$= 1/2 [\cos (7x/2 - x/2) - \cos (7x/2 + x/2) + \cos (11x/2 - 3x/2) - \cos (11x/2 + 3x/2)]$$

$$= 1/2 [\cos (7x-x)/2 - \cos (7x+x)/2 + \cos (11x-3x)/2 - \cos (11x+3x)/2]$$

$$= 1/2 [\cos 6x/2 - \cos 8x/2 + \cos 8x/2 - \cos 14x/2]$$

$$= 1/2 [\cos 3x - \cos 7x]$$

$$= -1/2 [\cos 7x - \cos 3x]$$

Again by using the formula,

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

$$= -1/2 [-2 \sin (7x+3x)/2 \sin (7x-3x)/2]$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= -1/2 [-2 \sin 10x/2 \sin 4x/2]$$

$$= -1/2 [-2 \sin 5x \sin 2x]$$

$$= -2/-2 \sin 5x \sin 2x$$

$$= \sin 2x \sin 5x$$

$$= \text{RHS}$$

Hence proved.

$$\text{(vii)} \cos x \cos x/2 - \cos 3x \cos 9x/2 = \sin 4x \sin 7x/2$$

Let us consider LHS:

$$\cos x \cos x/2 - \cos 3x \cos 9x/2 =$$

We shall multiply and divide by 2 we get,

$$= 1/2 [2 \cos x \cos x/2 - 2 \cos 9x/2 \cos 3x]$$

$$\text{We know that } 2 \cos A \cos B = \cos (A+B) + \cos (A-B)$$

So,

$$= 1/2 [\cos (x + x/2) + \cos (x - x/2) - \cos (9x/2 + 3x) - \cos (9x/2 - 3x)]$$

$$= 1/2 [\cos (2x+x)/2 + \cos (2x-x)/2 - \cos (9x+6x)/2 - \cos (9x-6x)/2]$$

$$= 1/2 [\cos 3x/2 + \cos x/2 - \cos 15x/2 - \cos 3x/2]$$

$$= 1/2 [\cos x/2 - \cos 15x/2]$$

$$= -1/2 [\cos 15x/2 - \cos x/2]$$

Again by using the formula,

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

$$= -1/2 [-2 \sin (15x/2 + x/2)/2 \sin (15x/2 - x/2)/2]$$

$$= -1/2 [-2 \sin (16x/2)/2 \sin (14x/2)/2]$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$= -1/2 [-2 \sin 16x/4 \sin 7x/2]$$

$$= -1/2 [-2 \sin 4x \sin 7x/2]$$

$$= -2/-2 [\sin 4x \sin 7x/2]$$

$$= \sin 4x \sin 7x/2$$

$$= \text{RHS}$$

Hence proved.

7. Prove that:

$$(i) \frac{\sin A + \sin 3A}{\cos A - \cos 3A} = \cot A$$

$$(ii) \frac{\sin 9A - \sin 7A}{\cos 7A - \cos 9A} = \cot 8A$$

$$(iii) \frac{\sin A - \sin B}{\cos A + \cos B} = \tan \frac{A - B}{2}$$

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

$$(v) \frac{\cos A + \cos B}{\cos B - \cos A} = \cot\left(\frac{A + B}{2}\right) \cot\left(\frac{A - B}{2}\right)$$

Solution:

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$(i) \frac{\sin A + \sin 3A}{\cos A - \cos 3A} = \cot A$$

Solution:

Let us consider LHS:

$$\frac{\sin A + \sin 3A}{\cos A - \cos 3A}$$

By using the formulas,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\cos A - \cos B = -2 \sin \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

So now,

$$\begin{aligned} \frac{\sin 3A + \sin A}{\cos A - \cos 3A} &= \frac{2(\sin \frac{A+3A}{2} \cos \frac{3A-A}{2})}{-2(\sin \frac{A+3A}{2} \sin \frac{A-3A}{2})} \\ &= -\frac{\sin \frac{4A}{2} \cos \frac{2A}{2}}{\sin \frac{4A}{2} \sin \frac{-2A}{2}} \\ &= -\frac{\cos A}{-\sin A} \quad (\text{since, } \sin(-A) = -\sin A) \\ &= \frac{\cos A}{\sin A} \\ &= \cot A \\ &= \text{RHS} \end{aligned}$$

Hence proved.

$$(ii) \frac{\sin 9A - \sin 7A}{\cos 7A - \cos 9A} = \cot 8A$$

Solution:

Let us consider LHS:

$$\frac{\sin 9A - \sin 7A}{\cos 7A - \cos 9A}$$

By using the formulas,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\cos A - \cos B = -2 \sin \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

So now,

$$\begin{aligned}\frac{\sin 9A - \sin 7A}{\cos 7A - \cos 9A} &= \frac{2(\cos \frac{9A+7A}{2} \sin \frac{9A-7A}{2})}{-2(\sin \frac{7A+9A}{2} \sin \frac{7A-9A}{2})} \\&= -\frac{(\cos \frac{16A}{2} \sin \frac{2A}{2})}{(\sin \frac{16A}{2} \sin \frac{(-2A)}{2})} \\&= -\frac{(\cos 8A \sin A)}{(-\sin 8A \sin A)} \text{ (since, } \sin(-A) = -\sin A) \\&= \frac{\cos 8A}{\sin 8A} \\&= \cot A \\&= \text{RHS}\end{aligned}$$

Hence proved.

$$(iii) \frac{\sin A - \sin B}{\cos A + \cos B} = \tan \frac{A - B}{2}$$

Solution:

Let us consider LHS:

$$\frac{\sin A - \sin B}{\cos A + \cos B}$$

By using the formulas,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

So now,

$$\frac{\sin A - \sin B}{\cos A + \cos B} = \frac{2(\cos \frac{A+B}{2} \sin \frac{A-B}{2})}{2(\cos \frac{A+B}{2} \cos \frac{A-B}{2})}$$

$$= \frac{\sin(\frac{A-B}{2})}{\cos(\frac{A-B}{2})}$$

$$= \tan \frac{A - B}{2}$$

= RHS

Hence proved.

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

Solution:

Let us consider LHS:

$$\frac{\sin A + \sin B}{\sin A - \sin B}$$

By using the formulas,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

So now,

$$\begin{aligned} \frac{\sin A + \sin B}{\sin A - \sin B} &= \frac{2\left(\sin \frac{A+B}{2} \cos \frac{A-B}{2}\right)}{2\left(\cos \frac{A+B}{2} \sin \frac{A-B}{2}\right)} \\ &= \frac{\sin \frac{A+B}{2} \cos \frac{A-B}{2}}{\cos \frac{A+B}{2} \sin \frac{A-B}{2}} \\ &= \tan\left(\frac{A+B}{2}\right) \cot\left(\frac{A-B}{2}\right) \end{aligned}$$

= RHS

Hence proved.

8. Prove that:

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$(i) \frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A} = \tan 3A$$

$$(ii) \frac{\cos 3A + 2\cos 5A + \cos 7A}{\cos A + 2\cos 3A + \cos 5A} = \frac{\cos 5A}{\cos 3A}$$

$$(iii) \frac{\cos 4A + \cos 3A + \cos 2A}{\sin 4A + \sin 3A + \sin 2A} = \cot 3A$$

$$(iv) \frac{\sin 3A + \sin 5A + \sin 7A + \sin 9A}{\cos 3A + \cos 5A + \cos 7A + \cos 9A} = \tan 6A$$

$$(v) \frac{\sin 5A - \sin 7A + \sin 8A - \sin 4A}{\cos 4A + \cos 7A - \cos 5A - \cos 8A} = \cot 6A$$

$$(vi) \frac{\sin 5A \cos 2A - \sin 6A \cos A}{\sin A \sin 2A - \cos 2A \cos 3A} = \tan A$$

$$(vii) \frac{\sin 11A \sin A + \sin 7A \sin 3A}{\cos 11A \sin A + \cos 7A \sin 3A} = \tan 8A$$

$$(viii) \frac{\sin 3A \cos 4A - \sin A \cos 2A}{\sin 4A \sin A + \cos 6A \cos A} = \tan 2A$$

$$(ix) \frac{\sin A \sin 2A + \sin 3A \sin 6A}{\sin A \cos 2A + \sin 3A \cos 6A} = \tan 5A$$

$$(x) \frac{\sin A + 2\sin 3A + \sin 5A}{\sin 3A + 2\sin 5A + \sin 7A} = \frac{\sin 3A}{\sin 5A}$$

$$(xi) \frac{\sin(\theta + \phi) - 2\sin \theta + \sin(\theta - \phi)}{\cos(\theta + \phi) - 2\cos \theta + \cos(\theta - \phi)} = \tan \theta$$

Solution:

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$(i) \frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A} = \tan 3A$$

Let us consider LHS:

$$\frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A}$$

By using the formulas,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

So now,

$$\begin{aligned} \frac{\sin A + \sin 3A + \sin 5A}{\cos A + \cos 3A + \cos 5A} &= \frac{(\sin 5A + \sin A) + \sin 3A}{(\cos 5A + \cos A) + \cos 3A} \\ &= \frac{\left(2 \sin \frac{5A + A}{2} \cos \frac{5A - A}{2}\right) + \sin 3A}{\left(2 \cos \frac{5A + A}{2} \cos \frac{5A - A}{2}\right) + \cos 3A} \\ &= \frac{\left(2 \sin \frac{6A}{2} \cos \frac{4A}{2}\right) + \sin 3A}{\left(2 \cos \frac{6A}{2} \cos \frac{4A}{2}\right) + \cos 3A} \\ &= \frac{(2 \sin 3A \cos 2A) + \sin 3A}{(2 \cos 3A \cos 2A) + \cos 3A} \\ &= \frac{\sin 3A (2 \cos 2A + 1)}{\cos 3A (2 \cos 2A + 1)} \\ &= \tan 3A \\ &= \text{RHS} \end{aligned}$$

Hence proved.

$$(iii) \frac{\cos 4A + \cos 3A + \cos 2A}{\sin 4A + \sin 3A + \sin 2A} = \cot 3A$$

Let us consider LHS:

$$\frac{\cos 4A + \cos 3A + \cos 2A}{\sin 4A + \sin 3A + \sin 2A}$$

By using the formula,

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

So now,

$$\begin{aligned} \frac{\cos 4A + \cos 3A + \cos 2A}{\sin 4A + \sin 3A + \sin 2A} &= \frac{(\cos 4A + \cos 2A) + \cos 3A}{(\sin 4A + \sin 2A) + \sin 3A} \\ &= \frac{\left(2 \cos \frac{4A + 2A}{2} \cos \frac{4A - 2A}{2}\right) + \cos 3A}{\left(2 \sin \frac{4A + 2A}{2} \cos \frac{4A - 2A}{2}\right) + \sin 3A} \\ &= \frac{\left(2 \cos \frac{6A}{2} \cos \frac{2A}{2}\right) + \cos 3A}{\left(2 \sin \frac{6A}{2} \cos \frac{2A}{2}\right) + \sin 3A} \\ &= \frac{(2 \cos 3A \cos A) + \cos 3A}{(2 \sin 3A \cos A) + \sin 3A} \\ &= \frac{\cos 3A (2 \cos A + 1)}{\sin 3A (2 \cos A + 1)} \\ &= \cot 3A \\ &= \text{RHS} \end{aligned}$$

Hence proved.

$$(iv) \frac{\sin 3A + \sin 5A + \sin 7A + \sin 9A}{\cos 3A + \cos 5A + \cos 7A + \cos 9A} = \tan 6A$$

Let us consider LHS:

$$\frac{\sin 3A + \sin 5A + \sin 7A + \sin 9A}{\cos 3A + \cos 5A + \cos 7A + \cos 9A}$$

By using the formulas,

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

So now,

$$\frac{\sin 3A + \sin 5A + \sin 7A + \sin 9A}{\cos 3A + \cos 5A + \cos 7A + \cos 9A}$$

When we rearrange we get,

$$\begin{aligned} &= \frac{(\sin 9A + \sin 3A) + (\sin 7A + \sin 5A)}{(\cos 9A + \cos 3A) + (\cos 7A + \cos 5A)} \\ &= \frac{\left(2 \sin \frac{9A + 3A}{2} \cos \frac{9A - 3A}{2}\right) + \left(2 \sin \frac{7A + 5A}{2} \cos \frac{7A - 5A}{2}\right)}{\left(2 \cos \frac{9A + 3A}{2} \cos \frac{9A - 3A}{2}\right) + \left(2 \cos \frac{7A + 5A}{2} \cos \frac{7A - 5A}{2}\right)} \\ &= \frac{\left(2 \sin \frac{12A}{2} \cos \frac{6A}{2}\right) + \left(2 \sin \frac{12A}{2} \cos \frac{2A}{2}\right)}{\left(2 \cos \frac{12A}{2} \cos \frac{6A}{2}\right) + \left(2 \cos \frac{12A}{2} \cos \frac{2A}{2}\right)} \\ &= \frac{(2 \sin 6A \cos 3A) + (2 \sin 6A \cos A)}{(2 \cos 6A \cos 3A) + (2 \cos 6A \cos A)} \\ &= \frac{2 \sin 6A (\cos 3A + \cos A)}{2 \cos 6A (\cos 3A + \cos A)} \\ &= \frac{\sin 6A}{\cos 6A} \\ &= \tan 6A \\ &= \text{RHS} \end{aligned}$$

Hence proved.

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

$$(v) \frac{\sin 5A - \sin 7A + \sin 8A - \sin 4A}{\cos 4A + \cos 7A - \cos 5A - \cos 8A} = \cot 6A$$

Let us consider LHS:

$$\frac{\sin 5A - \sin 7A + \sin 8A - \sin 4A}{\cos 4A + \cos 7A - \cos 5A - \cos 8A}$$

By using the formulas,

$$\cos A - \cos B = -2 \sin \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

So now,

$$\frac{\sin 5A - \sin 7A + \sin 8A - \sin 4A}{\cos 4A + \cos 7A - \cos 5A - \cos 8A} = \frac{-(\sin 7A - \sin 5A) + (\sin 8A - \sin 4A)}{(\cos 7A - \cos 5A) - (\cos 8A - \cos 4A)}$$

When we rearrange we get,

$$\begin{aligned} &= \frac{-\left(2 \cos \frac{7A + 5A}{2} \sin \frac{7A - 5A}{2}\right) + \left(2 \cos \frac{8A + 4A}{2} \sin \frac{8A - 4A}{2}\right)}{\left(-2 \sin \frac{7A + 5A}{2} \sin \frac{7A - 5A}{2}\right) - \left(-2 \sin \frac{8A + 4A}{2} \sin \frac{8A - 4A}{2}\right)} \\ &= \frac{-\left(2 \cos \frac{12A}{2} \sin \frac{2A}{2}\right) + \left(2 \cos \frac{12A}{2} \sin \frac{4A}{2}\right)}{\left(-2 \sin \frac{12A}{2} \sin \frac{2A}{2}\right) - \left(-2 \sin \frac{12A}{2} \sin \frac{4A}{2}\right)} \\ &= \frac{-(2 \cos 6A \sin A) + (2 \cos 6A \sin 2A)}{-(2 \sin 6A \sin A) + (2 \sin 6A \sin 2A)} \\ &= \frac{2 \cos 6A (-\sin A + \sin 2A)}{2 \sin 6A (-\sin A + \sin 2A)} \\ &= \frac{\cos 6A}{\sin 6A} \end{aligned}$$

$$= \cot 6A$$

$$= \text{RHS}$$

Hence proved.

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transform-ation-formulae/>

$$= \frac{-(\sin 5A - \sin 3A)}{-(\cos 5A + \cos 3A)}$$

$$= \frac{\sin 5A - \sin 3A}{\cos 5A + \cos 3A}$$

By using the formulas,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

so,

$$= \frac{2 \cos \frac{5A + 3A}{2} \sin \frac{5A - 3A}{2}}{2 \cos \frac{5A + 3A}{2} \cos \frac{5A - 3A}{2}}$$

$$= \frac{2 \cos \frac{5A + 3A}{2} \sin \frac{5A - 3A}{2}}{2 \cos \frac{5A + 3A}{2} \cos \frac{5A - 3A}{2}}$$

$$= \frac{2 \cos \frac{8A}{2} \sin \frac{2A}{2}}{2 \cos \frac{8A}{2} \cos \frac{2A}{2}}$$

$$= \frac{\sin A}{\cos A}$$

$$= \tan A$$

$$= \text{RHS}$$

Hence proved.

$$(vii) \frac{\sin 11A \sin A + \sin 7A \sin 3A}{\cos 11A \sin A + \cos 7A \sin 3A} = \tan 8A$$

Let us consider LHS:

$$\frac{\sin 11A \sin A + \sin 7A \sin 3A}{\cos 11A \sin A + \cos 7A \sin 3A}$$

Let us multiply and divide the above expression by 2 we get,

$$\frac{\sin 11A \sin A + \sin 7A \sin 3A}{\cos 11A \sin A + \cos 7A \sin 3A} = \frac{(2 \sin 11A \sin A) + (2 \sin 7A \sin 3A)}{(2 \cos 11A \sin A) + (2 \cos 7A \sin 3A)}$$

We know that, $2 \sin A \sin B = \cos(A - B) - \cos(A + B)$,

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

So now,

$$= \frac{\{\cos(11A - A) - \cos(11A + A)\} + \{\cos(7A - 3A) - \cos(7A + 3A)\}}{\{\sin(11A + A) - \sin(11A - A)\} + \{\sin(7A + 3A) - \sin(7A - 3A)\}}$$

$$= \frac{\{\cos 10A - \cos 12A\} + \{\cos 4A - \cos 10A\}}{\{\sin 12A - \sin 10A\} + \{\sin 10A - \sin 4A\}}$$

$$= \frac{\cos 10A - \cos 12A + \cos 4A - \cos 10A}{\sin 12A - \sin 10A + \sin 10A - \sin 4A}$$

$$= \frac{-(\cos 12A - \cos 4A)}{\sin 12A - \sin 4A}$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

By using the formulas,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\cos A - \cos B = -2 \sin \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

so,

$$\begin{aligned} &= -\frac{-2 \sin \frac{12A + 4A}{2} \sin \frac{12A - 4A}{2}}{2 \cos \frac{12A + 4A}{2} \sin \frac{12A - 4A}{2}} \\ &= \frac{\sin \frac{16A}{2} \sin \frac{8A}{2}}{\cos \frac{16A}{2} \sin \frac{8A}{2}} \\ &= \frac{\sin 8A}{\cos 8A} \\ &= \tan 8A \\ &= \text{RHS} \\ &\text{Hence proved.} \end{aligned}$$

$$(viii) \frac{\sin 3A \cos 4A - \sin A \cos 2A}{\sin 4A \sin A + \cos 6A \cos A} = \tan 2A$$

Let us consider LHS:

$$\frac{\sin 3A \cos 4A - \sin A \cos 2A}{\sin 4A \sin A + \cos 6A \cos A}$$

Let us multiply and divide the above expression by 2 we get,

$$\frac{\sin 3A \cos 4A - \sin A \cos 2A}{\sin 4A \sin A + \cos 6A \cos A} = \frac{(2 \sin 3A \cos 4A) - (2 \sin A \cos 2A)}{(2 \sin 4A \sin A) + (2 \cos 6A \cos A)}$$

We know that, $2 \sin A \sin B = \cos(A - B) - \cos(A + B)$,

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

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

So now,

$$\begin{aligned} &= \frac{\{\sin(3A + 4A) + \sin(3A - 4A)\} - \{\sin(A + 2A) + \sin(A - 2A)\}}{\{\cos(4A - A) - \cos(4A + A)\} + \{\cos(6A + A) + \cos(6A - A)\}} \\ &= \frac{\{\sin 7A + \sin(-A)\} - \{\sin 3A + \sin(-A)\}}{\{\cos 3A - \cos 5A\} + \{\cos 7A + \cos 5A\}} \\ &= \frac{\{\sin 7A - \sin A\} - \{\sin 3A - \sin A\}}{\{\cos 3A - \cos 5A\} + \{\cos 7A + \cos 5A\}} \quad (\text{since, } (-A) = -\sin A) \\ &= \frac{\sin 7A - \sin A - \sin 3A + \sin A}{\cos 3A - \cos 5A + \cos 7A + \cos 5A} \end{aligned}$$

$$= \frac{\sin 7A - \sin 3A}{\cos 7A + \cos 3A}$$

By using the formulas,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

so,

$$= \frac{2 \cos \frac{7A + 3A}{2} \sin \frac{7A - 3A}{2}}{2 \cos \frac{7A + 3A}{2} \cos \frac{7A - 3A}{2}}$$

$$= \frac{\cos \frac{10A}{2} \sin \frac{4A}{2}}{\cos \frac{10A}{2} \cos \frac{4A}{2}}$$

$$= \frac{\sin 2A}{\cos 2A}$$

$$= \tan 2A$$

$$= \text{RHS}$$

Hence proved.

$$(ix) \frac{\sin A \sin 2A + \sin 3A \sin 6A}{\sin A \cos 2A + \sin 3A \cos 6A} = \tan 5A$$

Let us consider LHS:

$$\frac{\sin A \sin 2A + \sin 3A \sin 6A}{\sin A \cos 2A + \sin 3A \cos 6A}$$

Let us multiply and divide the above expression by 2 we get,

$$\frac{\sin A \sin 2A + \sin 3A \sin 6A}{\sin A \cos 2A + \sin 3A \cos 6A} = \frac{(2 \sin 2A \sin A) + (2 \sin 6A \sin 3A)}{(2 \sin A \cos 2A) + (2 \sin 3A \cos 6A)}$$

We know that, $2 \sin A \sin B = \cos(A - B) - \cos(A + B)$,

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

So now,

$$\begin{aligned} &= \frac{\{\cos(2A - A) - \cos(2A + A)\} + \{\cos(6A - 3A) - \cos(6A + 3A)\}}{\{\sin(A + 2A) + \sin(A - 2A)\} + \{\sin(3A + 6A) + \sin(3A - 6A)\}} \\ &= \frac{\{\cos A - \cos 3A\} + \{\cos 3A - \cos 9A\}}{\{\sin 3A + \sin(-A)\} + \{\sin 9A + \sin(-3A)\}} \end{aligned}$$

$$\begin{aligned}
 &= \frac{\{\cos A - \cos 3A\} + \{\cos 3A - \cos 9A\}}{\{\sin 3A - \sin A\} + \{\sin 9A - \sin 3A\}} \quad (\text{since, } \sin(-A) = -\sin A) \\
 &= \frac{\cos A - \cos 3A + \cos 3A - \cos 9A}{\sin 3A - \sin A + \sin 9A - \sin 3A} \\
 &= \frac{\cos A - \cos 9A}{\sin 9A - \sin A} \\
 &= \frac{-(\cos 9A - \cos A)}{\sin 9A - \sin A}
 \end{aligned}$$

By using the formulas,

$$\sin A - \sin B = 2 \cos \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

$$\cos A - \cos B = -2 \sin \frac{(A+B)}{2} \sin \frac{(A-B)}{2}$$

so,

$$\begin{aligned}
 &= - \frac{-2 \sin \frac{9A + A}{2} \sin \frac{9A - A}{2}}{2 \cos \frac{9A + A}{2} \sin \frac{9A - A}{2}} \\
 &= \frac{\sin \frac{10A}{2} \sin \frac{8A}{2}}{\cos \frac{10A}{2} \sin \frac{8A}{2}} \\
 &= \frac{\sin 5A}{\cos 5A} \\
 &= \tan 5A
 \end{aligned}$$

= RHS

Hence proved.

$$(x) \frac{\sin A + 2\sin 3A + \sin 5A}{\sin 3A + 2\sin 5A + \sin 7A} = \frac{\sin 3A}{\sin 5A}$$

Let us consider LHS:

$$\frac{\sin A + 2\sin 3A + \sin 5A}{\sin 3A + 2\sin 5A + \sin 7A}$$
$$\frac{\sin A + 2\sin 3A + \sin 5A}{\sin 3A + 2\sin 5A + \sin 7A} = \frac{(\sin 5A + \sin A) + 2\sin 3A}{(\sin 7A + \sin 3A) + 2\sin 5A}$$

We know that,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

So now,

$$= \frac{\left(2 \sin \frac{5A + A}{2} \cos \frac{5A - A}{2}\right) + 2\sin 3A}{\left(2 \sin \frac{7A + 3A}{2} \cos \frac{7A - 3A}{2}\right) + 2\sin 5A}$$
$$= \frac{\left(2 \sin \frac{6A}{2} \cos \frac{4A}{2}\right) + 2\sin 3A}{\left(2 \sin \frac{10A}{2} \cos \frac{4A}{2}\right) + 2\sin 5A}$$
$$= \frac{(2 \sin 3A \cos 2A) + 2\sin 3A}{(2 \sin 5A \cos 2A) + 2\sin 5A}$$
$$= \frac{2 \sin 3A (\cos 2A + 1)}{2 \sin 5A (\cos 2A + 1)}$$
$$= \frac{\sin 3A}{\sin 5A}$$

= RHS

Hence proved.

$$(xi) \frac{\sin(\theta + \phi) - 2\sin\theta + \sin(\theta - \phi)}{\cos(\theta + \phi) - 2\cos\theta + \cos(\theta - \phi)} = \tan\theta$$

Let us consider LHS:

$$\frac{\sin(\theta + \phi) - 2\sin\theta + \sin(\theta - \phi)}{\cos(\theta + \phi) - 2\cos\theta + \cos(\theta - \phi)}$$

$$\frac{\sin(\theta + \phi) - 2\sin\theta + \sin(\theta - \phi)}{\cos(\theta + \phi) - 2\cos\theta + \cos(\theta - \phi)} = \frac{\{\sin(\theta + \phi) + \sin(\theta - \phi)\} - 2\sin\theta}{\{\cos(\theta + \phi) + \cos(\theta - \phi)\} - 2\cos\theta}$$

We know that,

$$\sin A + \sin B = 2 \sin \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

$$\cos A + \cos B = 2 \cos \frac{(A+B)}{2} \cos \frac{(A-B)}{2}$$

So now,

$$= \frac{\left(2 \sin \frac{\theta + \phi + \theta - \phi}{2} \cos \frac{\theta + \phi - \theta + \phi}{2}\right) - 2 \sin \theta}{\left(2 \cos \frac{\theta + \phi + \theta - \phi}{2} \cos \frac{\theta + \phi - \theta + \phi}{2}\right) - 2 \cos \theta}$$

$$= \frac{\left(2 \sin \frac{2\theta}{2} \cos \frac{2\phi}{2}\right) - 2 \sin \theta}{\left(2 \cos \frac{2\theta}{2} \cos \frac{2\phi}{2}\right) - 2 \cos \theta}$$

$$= \frac{(2 \sin \theta \cos \phi) - 2 \sin \theta}{(2 \cos \theta \cos \phi) - 2 \cos \theta}$$

$$= \frac{2 \sin \theta (\cos \phi - 1)}{2 \cos \theta (\cos \phi - 1)}$$

$$= \frac{\sin \theta}{\cos \theta}$$

$$= \tan \theta$$

$$= \text{RHS}$$

Hence proved.

9. Prove that:

$$(i) \sin \alpha + \sin \beta + \sin \gamma - \sin(\alpha + \beta + \gamma) = 4 \sin \frac{(\alpha + \beta)}{2} \sin \frac{(\beta + \gamma)}{2} \sin \frac{(\alpha + \gamma)}{2}$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformations-formulae/>

(ii) $\cos (A + B + C) + \cos (A - B + C) + \cos (A + B - C) + \cos (-A + B + C) = 4 \cos A \cos B \cos C$

Solution:

(i) $\sin \alpha + \sin \beta + \sin \gamma - \sin (\alpha + \beta + \gamma) = 4 \sin (\alpha + \beta)/2 \sin (\beta + \gamma)/2 \sin (\alpha + \gamma)/2$

Let us consider LHS:

$$\sin \alpha + \sin \beta + \sin \gamma - \sin (\alpha + \beta + \gamma)$$

By using the formulas,

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

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

$$\begin{aligned}& \sin \alpha + \sin \beta + \sin \gamma - \sin (\alpha + \beta + \gamma) \\&= (\sin \alpha + \sin \beta) + \{\sin \gamma - \sin (\alpha + \beta + \gamma)\} \\&= \left(2 \sin \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2}\right) + \left(2 \cos \frac{\gamma + \alpha + \beta + \gamma}{2} \sin \frac{\gamma - \alpha - \beta - \gamma}{2}\right) \\&= \left(2 \sin \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2}\right) + \left(2 \cos \frac{\alpha + \beta + 2\gamma}{2} \sin \frac{-(\alpha + \beta)}{2}\right) \\&= \left(2 \sin \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2}\right) - \left(2 \cos \frac{\alpha + \beta + 2\gamma}{2} \sin \frac{\alpha + \beta}{2}\right) \quad (\text{since, } \sin (-A) = -\sin A) \\&= 2 \sin \frac{\alpha + \beta}{2} \left(\cos \frac{\alpha - \beta}{2} - \cos \frac{\alpha + \beta + 2\gamma}{2}\right)\end{aligned}$$

Again by using the formula,

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

$$\begin{aligned}
 &= 2 \sin \frac{\alpha + \beta}{2} \left(-2 \sin \frac{\frac{\alpha - \beta}{2} + \frac{\alpha + \beta + 2\gamma}{2}}{2} \sin \frac{\frac{\alpha - \beta}{2} - \frac{\alpha + \beta + 2\gamma}{2}}{2} \right) \\
 &= 2 \sin \frac{\alpha + \beta}{2} \left(-2 \sin \frac{\frac{\alpha - \beta + \alpha + \beta + 2\gamma}{2}}{2} \sin \frac{\frac{\alpha - \beta - (\alpha + \beta + 2\gamma)}{2}}{2} \right) \\
 &= 2 \sin \frac{\alpha + \beta}{2} \left(-2 \sin \frac{2\alpha + 2\gamma}{2} \sin \frac{\alpha - \beta - \alpha - \beta - 2\gamma}{2} \right) \\
 &= 2 \sin \frac{\alpha + \beta}{2} \left(-2 \sin \frac{2\alpha + 2\gamma}{2} \sin \frac{-2\beta - 2\gamma}{2} \right) \\
 &= 2 \sin \frac{\alpha + \beta}{2} \left(-2 \sin \frac{2(\alpha + \gamma)}{2} \sin \frac{-2(\beta + \gamma)}{2} \right) \\
 &= 2 \sin \frac{\alpha + \beta}{2} \left(-2 \sin \frac{\alpha + \gamma}{2} \sin \frac{-(\beta + \gamma)}{2} \right) \\
 &= 2 \sin \frac{\alpha + \beta}{2} \left(2 \sin \frac{\alpha + \gamma}{2} \sin \frac{\beta + \gamma}{2} \right) \\
 &= 4 \sin \frac{\alpha + \beta}{2} \sin \frac{\beta + \gamma}{2} \sin \frac{\alpha + \gamma}{2}
 \end{aligned}$$

= RHS

Hence proved.

(ii) $\cos (A + B + C) + \cos (A - B + C) + \cos (A + B - C) + \cos (-A + B + C) = 4 \cos A \cos B \cos C$

Let us consider LHS:

$$\cos (A + B + C) + \cos (A - B + C) + \cos (A + B - C) + \cos (-A + B + C)$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

so,

$$\begin{aligned} &\cos (A+B+C)+\cos (A-B+C)+\cos (A+B-C)+\cos (-A+B+C)= \\ &=\{\cos (A+B+C)+\cos (A-B+C)\}+\{\cos (A+B-C)+\cos (-A+B+C)\} \end{aligned}$$

By using the formula,

$$\cos A+\cos B=2 \cos (A+B) / 2 \cos (A-B) / 2$$

$$\begin{aligned} &=\left\{2 \cos \frac{(A+B+C)+(A-B+C)}{2} \cos \frac{(A+B+C)-(A-B+C)}{2}\right\} \\ &+\left\{2 \cos \frac{(A+B-C)+(-A+B+C)}{2} \cos \frac{(A+B-C)-(-A+B+C)}{2}\right\} \\ &=\left\{2 \cos \frac{A+B+C+A-B+C}{2} \cos \frac{A+B+C-A+B-C}{2}\right\} \\ &\quad +\left\{2 \cos \frac{A+B-C-A+B+C}{2} \cos \frac{A+B-C+A-B-C}{2}\right\} \\ &=\left\{2 \cos \frac{2 A+2 C}{2} \cos \frac{2 B}{2}\right\}+\left\{2 \cos \frac{2 B}{2} \cos \frac{2 A-2 C}{2}\right\} \\ &=\left\{2 \cos \frac{2(A+C)}{2} \cos \frac{2 B}{2}\right\}+\left\{2 \cos \frac{2 B}{2} \cos \frac{2(A-C)}{2}\right\} \\ &=2 \cos (A+C) \cos B+2 \cos B \cos (A-C) \\ &=2 \cos B\{\cos (A+C)+\cos (A-C)\} \end{aligned}$$

By using the formula,

$$\begin{aligned} &\cos A+\cos B=2 \cos (A+B) / 2 \cos (A-B) / 2 \\ &=2 \cos B\left\{2 \cos \frac{A+C+(A-C)}{2} \cos \frac{A+C-(A-C)}{2}\right\} \\ &=2 \cos B\left\{2 \cos \frac{A+C+A-C}{2} \cos \frac{A+C-A+C}{2}\right\} \\ &=2 \cos B\left\{2 \cos \frac{2 A}{2} \cos \frac{2 C}{2}\right\} \end{aligned}$$

$$=4 \cos A \cos B \cos C$$

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transform-ation-formulae/>

= RHS

Hence proved.



Chapterwise RD Sharma Solutions for Class 11 Maths :

- Chapter 1–Sets
- Chapter 2–Relations
- Chapter 3–Functions
- Chapter 4–Measurement of Angles
- Chapter 5–Trigonometric Functions
- Chapter 6–Graphs of Trigonometric Functions
- Chapter 7–Values of Trigonometric Functions at Sum or Difference of Angles
- Chapter 8–Transformation Formulae
- Chapter 9–Values of Trigonometric Functions at Multiples and Submultiples of an Angle
- Chapter 10–Sine and Cosine Formulae and their Applications
- Chapter 11–Trigonometric Equations
- Chapter 12–Mathematical Induction
- Chapter 13–Complex Numbers
- Chapter 14–Quadratic Equations
- Chapter 15–Linear Inequations
- Chapter 16–Permutations
- Chapter 17–Combinations
- Chapter 18–Binomial Theorem
- Chapter 19–Arithmetic Progressions
- Chapter 20–Geometric Progressions

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

- Chapter 21–Some Special Series
- Chapter 22–Brief review of Cartesian System of Rectangular Coordinates
- Chapter 23–The Straight Lines
- Chapter 24–The Circle
- Chapter 25–Parabola
- Chapter 26–Ellipse
- Chapter 27–Hyperbola
- Chapter 28–Introduction to Three Dimensional Coordinate Geometry
- Chapter 29–Limits
- Chapter 30–Derivatives
- Chapter 31–Mathematical Reasoning
- Chapter 32–Statistics
- Chapter 33–Probability

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>

About RD Sharma

RD Sharma isn't the kind of author you'd bump into at lit fests. But his bestselling books have helped many CBSE students lose their dread of maths. Sunday Times profiles the tutor turned internet star

He dreams of algorithms that would give most people nightmares. And, spends every waking hour thinking of ways to explain concepts like 'series solution of linear differential equations'. Meet Dr Ravi Dutt Sharma — mathematics teacher and author of 25 reference books — whose name evokes as much awe as the subject he teaches. And though students have used his thick tomes for the last 31 years to ace the dreaded maths exam, it's only recently that a spoof video turned the tutor into a YouTube star.

R D Sharma had a good laugh but said he shared little with his on-screen persona except for the love for maths. "I like to spend all my time thinking and writing about maths problems. I find it relaxing," he says. When he is not writing books explaining mathematical concepts for classes 6 to 12 and engineering students, Sharma is busy dispensing his duty as vice-principal and head of department of science and humanities at Delhi government's Guru Nanak Dev Institute of Technology.

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-11-maths-chapter-8-transformation-formulae/>