## EXERCISE 5.3

**Find the values of the following trigonometric ratios:**
**(i) sin 5π/3**
**(ii) sin 17π**
**(iii) tan 11π/6**
**(iv) cos (-25π/4)**
**(v) tan 7π/4**
**(vi) sin 17π/6**
**(vii) cos 19π/6**
**(viii) sin (-11π/6)**
**(ix) cosec (-20π/3)**
**(x) tan (-13π/4)**
**(xi) cos 19π/4**
**(xii) sin 41π/4**
**(xiii) cos 39π/4**
**(xiv) sin 151π/6**

**Solution:**

**(i)** sin 5π/3

$5\pi/3 = (5/3 \times 180)^o$

$= 300^o$

$= (90\times3 + 30)^o$

Since, $300^o$ lies in IV quadrant in which sine function is negative.

$\sin 5\pi/3 = \sin (300)^o$

$= \sin (90\times3 + 30)^o$

$= -\cos 30^o$

$= -\sqrt{3}/2$

**(ii)** sin 17π

$\text{Sin } 17\pi = \sin 3060^o$

$= \sin (90\times34 + 0)^o$

Since, $3060^o$ lies in the negative direction of x-axis i.e., on boundary line of II and III quadrants.

$\text{Sin } 17\pi = \sin (90\times34 + 0)^o$

$= -\sin 0^o$

$= 0$

**(iii)** tan 11π/6

$\tan 11\pi/6 = (11/6 \times 180)^o$

$= 330^o$

Since, $330^o$ lies in the IV quadrant in which tangent function is negative.

$\tan 11\pi/6 = \tan (300)^o$
$= \tan (90\times3 + 60)^o$
$= - \cot 60^o$
$= - 1/\sqrt{3}$

**(iv)** $\cos (-25\pi/4)$

$\cos (-25\pi/4) = \cos (-1125)^o$
$= \cos (1125)^o$

Since, $1125^o$ lies in the I quadrant in which cosine function is positive.

$\cos (1125)^o = \cos (90\times12 + 45)^o$
$= \cos 45^o$
$= 1/\sqrt{2}$

**(v)** $\tan 7\pi/4$

$\tan 7\pi/4 = \tan 315^o$
$= \tan (90\times3 + 45)^o$

Since, $315^o$ lies in the IV quadrant in which tangent function is negative.

$\tan 315^o = \tan (90\times3 + 45)^o$
$= - \cot 45^o$
$= -1$



**(vi)** $\sin 17\pi/6$

$\sin 17\pi/6 = \sin 510^o$
$= \sin (90\times5 + 60)^o$

Since, $510^o$ lies in the II quadrant in which sine function is positive.

$\sin 510^o = \sin (90\times5 + 60)^o$
$= \cos 60^o$
$= 1/2$

**(vii)** $\cos 19\pi/6$

$\cos 19\pi/6 = \cos 570^o$
$= \cos (90\times6 + 30)^o$

Since, $570^o$ lies in III quadrant in which cosine function is negative.

$\cos 570^o = \cos (90\times6 + 30)^o$
$= - \cos 30^o$
$= - \sqrt{3}/2$

**(viii)** sin (-11π/6)

sin (-11π/6) = sin (-330°)

= - sin (90×3 + 60)°

Since, 330° lies in the IV quadrant in which the sine function is negative.

sin (-330°) = - sin (90×3 + 60)°

= - (-cos 60°)

= - (-1/2)

= 1/2

**(ix)** cosec (-20π/3)

cosec (-20π/3) = cosec (-1200)°

= - cosec (1200)°

= - cosec (90×13 + 30)°

Since, 1200° lies in the II quadrant in which cosec function is positive.

cosec (-1200)° = - cosec (90×13 + 30)°

= - sec 30°

= -2/√3

**(x)** tan (-13π/4)

tan (-13π/4) = tan (-585)°

= - tan (90×6 + 45)°

Since, 585° lies in the III quadrant in which the tangent function is positive.

tan (-585)° = - tan (90×6 + 45)°

= - tan 45°

= -1

**(xi)** cos 19π/4

cos 19π/4 = cos 855°

= cos (90×9 + 45)°

Since, 855° lies in the II quadrant in which the cosine function is negative.

cos 855° = cos (90×9 + 45)°

= - sin 45°

= - 1/√2

**(xii)** sin 41π/4

sin 41π/4 = sin 1845°

= sin (90×20 + 45)°

Since, 1845° lies in the I quadrant in which the sine function is positive.

sin 1845° = sin (90×20 + 45)°

= sin 45°
= 1/√2

**(xiii)** cos 39π/4
cos 39π/4 = cos 1755°
= cos (90×19 + 45)°
Since, 1755° lies in the IV quadrant in which the cosine function is positive.
cos 1755° = cos (90×19 + 45)°
= sin 45°
= 1/√2

**(xiv)** sin 151π/6
sin 151π/6 = sin 4530°
= sin (90×50 + 30)°
Since, 4530° lies in the III quadrant in which the sine function is negative.
sin 4530° = sin (90×50 + 30)°
= - sin 30°
= -1/2

**2. prove that:**
**(i) tan 225° cot 405° + tan 765° cot 675° = 0**
**(ii) sin 8π/3 cos 23π/6 + cos 13π/3 sin 35π/6 = 1/2**
**(iii) cos 24° + cos 55° + cos 125° + cos 204° + cos 300° = 1/2**
**(iv) tan (-125°) cot (-405°) – tan (-765°) cot (675°) = 0**
**(v) cos 570° sin 510° + sin (-330°) cos (-390°) = 0**
**(vi) tan 11π/3 – 2 sin 4π/6 – 3/4 cosec² π/4 + 4 cos² 17π/6 = (3 - 4√3)/2**
**(vii) 3 sin π/6 sec π/3 – 4 sin 5π/6 cot π/4 = 1**
**Solution:**
**(i)** tan 225° cot 405° + tan 765° cot 675° = 0
Let us consider LHS:
tan 225° cot 405° + tan 765° cot 675°
tan (90° × 2 + 45°) cot (90° × 4 + 45°) + tan (90° × 8 + 45°) cot (90° × 7 + 45°)
We know that when n is odd, cot → tan.
tan 45° cot 45° + tan 45° [-tan 45°]
tan 45° cot 45° - tan 45° tan 45°
1 × 1 – 1 × 1
1 – 1
0 = RHS
∴ LHS = RHS

Hence proved.

**(ii)** sin 8π/3 cos 23π/6 + cos 13π/3 sin 35π/6 = 1/2
Let us consider LHS:
sin 8π/3 cos 23π/6 + cos 13π/3 sin 35π/6
sin 480° cos 690° + cos 780° sin 1050°
sin (90° × 5 + 30°) cos (90° × 7 + 60°) + cos (90° × 8 + 60°) sin (90° × 11 + 60°)
We know that when n is odd, sin → cos and cos → sin.
cos 30° sin 60° + cos 60° [-cos 60°]
√3/2 × √3/2 – 1/2 × 1/2
3/4 - 1/4
2/4
1/2
= RHS
∴ LHS = RHS
Hence proved.

**(iii)** cos 24° + cos 55° + cos 125° + cos 204° + cos 300° = 1/2
Let us consider LHS:
cos 24° + cos 55° + cos 125° + cos 204° + cos 300°
cos 24° + cos (90° × 1 – 35°) + cos (90° × 1 + 35°) + cos (90° × 2 + 24°) + cos (90° × 3 + 30°)
We know that when n is odd, cos → sin.
cos 24° + sin 35° - sin 35° - cos 24° + sin 30°
0 + 0 + 1/2
1/2
= RHS
∴ LHS = RHS
Hence proved.

**(iv)** tan (-125°) cot (-405°) – tan (-765°) cot (675°) = 0
Let us consider LHS:
tan (-125°) cot (-405°) – tan (-765°) cot (675°)
We know that tan (-x) = -tan (x) and cot (-x) = -cot (x).
[-tan (225°)] [-cot (405°)] – [-tan (765°)] cot (675°)
tan (225°) cot (405°) + tan (765°) cot (675°)
tan (90° × 2 + 45°) cot (90° × 4 + 45°) + tan (90° × 8 + 45°) cot (90° × 7 + 45°)
tan 45° cot 45° + tan 45° [-tan 45°]
1 × 1 + 1 × (-1)