

A hand-drawn unit circle on a coordinate plane. The circle is centered at the origin (0,0) and has a radius of 1. The x and y axes are labeled with 0 at the origin. The circle is divided into 12 equal segments by radial lines. The angles are labeled in degrees (°) and radians (π) around the circle. The tangent values are written outside the circle, often with arrows pointing to the corresponding angle. Some values are highlighted in yellow or green.

Angle (Degrees)	Angle (Radians)	Tangent Value
0°	0	0
30°	$\frac{\pi}{6}$	$\frac{1}{\sqrt{3}}$
45°	$\frac{\pi}{4}$	1
60°	$\frac{\pi}{3}$	$\sqrt{3}$
90°	$\frac{\pi}{2}$	Undefined
120°	$\frac{2\pi}{3}$	$-\sqrt{3}$
135°	$\frac{3\pi}{4}$	-1
150°	$\frac{5\pi}{6}$	$-\frac{1}{\sqrt{3}}$
180°	π	0
210°	$\frac{7\pi}{6}$	$\frac{1}{\sqrt{3}}$
225°	$\frac{5\pi}{4}$	1
240°	$\frac{4\pi}{3}$	$\sqrt{3}$
270°	$\frac{3\pi}{2}$	Undefined
300°	$\frac{5\pi}{3}$	$-\frac{1}{\sqrt{3}}$
315°	$\frac{7\pi}{4}$	-1
330°	$\frac{11\pi}{6}$	$\frac{1}{\sqrt{3}}$

$$\theta = 0^\circ \rightarrow \tan \frac{\pi}{r} = 0 \quad \left\{ \begin{array}{l} \text{---} \\ \text{---} \end{array} \right. \quad \theta = 90^\circ \rightarrow \tan \frac{\pi}{r} = \infty$$

$$\theta = 180^\circ \rightarrow \left\{ \tan \pi = 0 \right\} \quad \theta = 270^\circ \rightarrow \left\{ \tan \frac{3\pi}{2} = \text{تن} \right\}$$

$$\theta = 45^\circ \rightarrow \left\{ \tan \frac{\pi}{4} = 1 \right\} \quad \theta = 135^\circ \rightarrow \left\{ \tan \frac{3\pi}{4} = -1 \right\}$$

$$\theta = 45^\circ \rightarrow \left\{ \tan \frac{\omega \pi}{k} = 1 \right\} \quad \theta = 135^\circ \rightarrow \left\{ \tan \frac{\omega \pi}{k} = -1 \right\}$$

$$\text{الف) } \frac{\sin \frac{\pi}{4}}{\frac{1}{\sqrt{2}}} + \frac{\cos \frac{\pi}{4}}{-1} + \frac{\tan \frac{\pi}{4}}{-\sqrt{2}} = \frac{-\sqrt{2}}{\sqrt{2}} = -1$$

$$\text{ب) } \frac{-\cos \frac{\pi}{4}}{\frac{\sqrt{3}}{4}} + \frac{\sin \frac{\pi}{4}}{\frac{\sqrt{2}}{2}} - \frac{\tan \frac{\pi}{4}}{\frac{4\sqrt{2}}{\sqrt{3}}} = \frac{\sqrt{6}}{4}$$

$$\text{ج) } \frac{\cot \frac{\pi}{4}}{\frac{\sqrt{2}}{2}} + \frac{\cot \frac{\pi}{4}}{\frac{4\sqrt{2}}{\sqrt{3}}} - \frac{\tan \frac{\pi}{4}}{\frac{4\sqrt{2}}{\sqrt{3}}} = \frac{\sqrt{6}}{2}$$

$$\text{د) } \cos \left(\sin \frac{\pi}{4} \right) + \sin \left(\cos \frac{\pi}{4} \right) = 1$$

$$a^r + r a = r a + r$$

$$a^r + a - r = 0 \rightarrow a = 1, -r$$

$$f_1 = -1 + r = a$$

$$f_x = \begin{cases} rx^r - b & x > 1, \quad x < -r \\ a + rx & -r < x < -1 \end{cases}$$

$$x = -r \rightarrow a - r = 1 - b \rightarrow a + b = r$$

الف) $y = \frac{1}{x^3 - x^2} = \frac{1}{x^2(x-1)}$

$D_f = \mathbb{R} - \{0, 1\}$

ب) $y = \frac{1}{x^3 + x^2 + x + 1} = \frac{1}{(1+x^2)(x+1)}$

$D_f = \mathbb{R} - \{-1\}$

$x^2 - 1 > 0 \rightarrow \frac{1}{x-1} > \frac{1}{x+1}$

الف) $\sqrt{x^2-1} + \sqrt{x-2}$

$(-\infty, -1] \cup [1, +\infty) \cap x > 2 \Rightarrow D_f = [2, +\infty)$

ب) $y = \frac{\sqrt{4-x^2}}{\sqrt{4x-3}}$

$4-x^2 > 0 \rightarrow x \leq 2$

$4x-3 > 0 \rightarrow x > \frac{3}{4}$

$D_f = (\frac{3}{4}, 2]$

$\frac{3}{4} < x \leq 2$

$\begin{cases} 4x-a > 0 \rightarrow x > \frac{a}{4} \\ b-3x > 0 \rightarrow x < \frac{b}{3} \end{cases}$

$\Rightarrow \frac{a}{4} = \frac{b}{3} = 2$

$a=12$

$b=4$

$\Rightarrow \frac{b}{a} = \frac{1}{3}$

$$\text{الف) } \sqrt{\frac{x^2 - x - 4}{x^2 - 13x^2 + 34}} = \sqrt{\frac{(x-2)(x+2)}{(x-2)(x+2)(x+3)(x-3)}}$$

$$\begin{array}{c|c|c|c|c} x & x^* & x & x^* & \\ \hline + & - & - & + & + \\ \hline \end{array}$$

$$D_f = (-\infty, -2) \cup (2, 3) \cup (3, +\infty)$$

$$\text{ب) } \sqrt{\frac{x^3 - 2x^2 - 5x + 4}{x^3 + 2x^2 - 5x - 4}} = \sqrt{\frac{(x-1)(x-3)(x+2)}{(x+1)(x+3)(x-2)}}$$

$$\begin{array}{c|c|c|c|c|c|c} x & x & x & x & x & x & x \\ \hline + & - & + & - & + & - & + \\ \hline \end{array}$$

$$D_f = (-\infty, -3) \cup [-2, -1) \cup [1, 2) \cup [3, +\infty)$$

$$\text{الف) } \sqrt{2[x] - 4} \rightarrow [x] \geq 2 \rightarrow x \geq 2$$

$$D_f = [2, +\infty)$$

$$\text{ب) } \sqrt{2[x] - 5} \rightarrow [x] \geq \frac{5}{2} \rightarrow x \geq \frac{5}{2}$$

$$D_f = [\frac{5}{2}, +\infty)$$

$$\text{الف) } \sqrt{\frac{x+1}{|x-3|}} + \sqrt{\frac{4-x}{(x+2)^2}}$$

$$\begin{array}{c|c} x & x \\ \hline - & + \\ \hline \end{array}$$

$$\begin{array}{c|c} x & x \\ \hline + & - \\ \hline \end{array}$$

$$D_f = [-1, 3) \cup (3, 4]$$

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$$b) \dots \sqrt{[a] - f} + \sqrt{r - [a]}$$

$$[a] > f$$

$$[a] < r$$

$$\Rightarrow D_f = \emptyset$$

$$a > f$$

$$a < r$$