

Trig. Basics Examples

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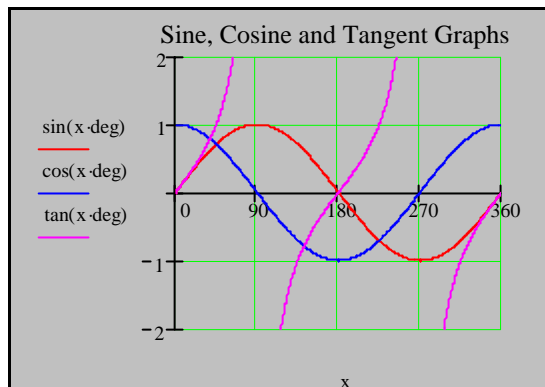
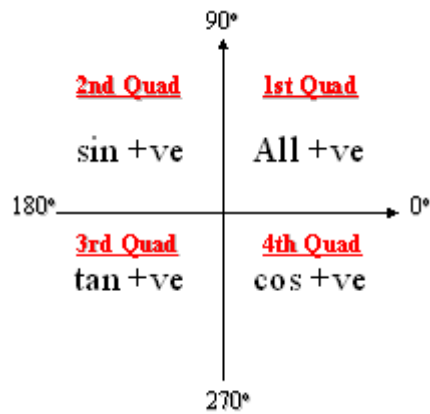
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1. Find the values for x in the range $0^\circ \leq x \leq 360^\circ$

- | | |
|------------------------|-------------------------|
| (a) $\sin x^\circ = 0$ | (d) $\sin x^\circ = -1$ |
| (b) $\cos x^\circ = 0$ | (e) $\cos x^\circ = -1$ |
| (c) $\tan x^\circ = 0$ | (f) $\tan x^\circ = 1$ |

Solution

Remembering!!!



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(a) $\sin x^\circ = 0$ $x = 0^\circ, 180^\circ, 360^\circ$

(b) $\cos x^\circ = 0$ $x = 90^\circ, 270^\circ$

(c) $\tan x^\circ = 0$ $x = 0^\circ, 180^\circ, 360^\circ$

(d) $\sin x^\circ = -1$ $x = 270^\circ$

(e) $\cos x^\circ = -1$ $x = 180^\circ$

(f) $\tan x^\circ = 1$ $x = 45^\circ, 225^\circ$

2. Solve for x in the range $0 \leq x \leq 90^\circ$

(a) $\frac{1}{\sqrt{3}} \tan x = 1$

b) $\frac{2}{\sqrt{3}} \cos x = 1$

(c) $\sqrt{2} \sin x = 1$

(d) $\sqrt{2} \cos x = 1$

Solution

(a) $\frac{1}{\sqrt{3}} \tan x = 1$ $\tan x = \frac{\sqrt{3}}{1} = \sqrt{3}$ $x = \tan^{-1}(\sqrt{3}) = 60^\circ$

(b) $\frac{2}{\sqrt{3}} \cos x = 1$ $\cos x = \frac{\sqrt{3}}{2}$ $x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) = 30^\circ$

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$$(c) \quad \sqrt{2} \sin x = 1 \quad \sin x = \frac{1}{\sqrt{2}} \quad x = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right) = 45^\circ$$

$$(d) \quad \sqrt{2} \cos x = 1 \quad \cos x = \frac{1}{\sqrt{2}} \quad x = \cos^{-1}\left(\frac{1}{\sqrt{2}}\right) = 45^\circ$$

3. Write down the maximum and minimum co-ordinates for the sine, cosine and tangent functions and their periods between $0^\circ \leq x \leq 360^\circ$

Solution

From the graphs in Q1 we have

	Sine	Cosine	Tangent
Maximum value	$(90^\circ, 1)$	$(0^\circ, 1)$	not defined
Minimum value	$(270^\circ, -1)$	$(180^\circ, -1)$	not defined
Period in degrees	360°	360°	180°

You are expected to have this information at your fingertips!!!!

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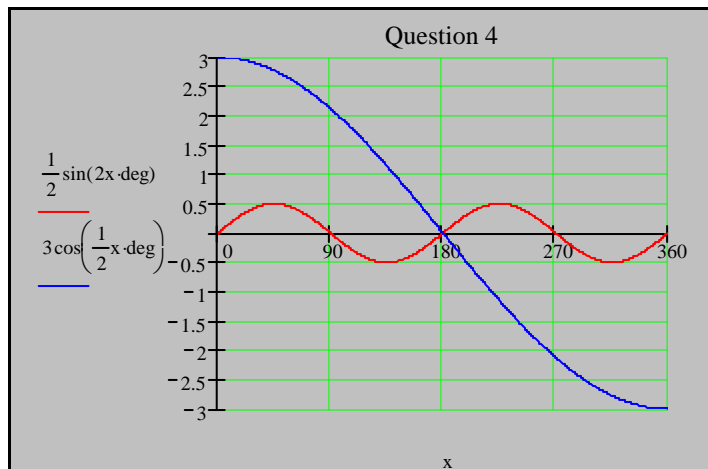
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4. Repeat Question 3 for the following functions.

(a) $\frac{1}{2} \cdot \sin 2x$

(b) $3 \cdot \cos\left(\frac{1}{2}x\right)$

Solution



(a) $\frac{1}{2} \cdot \sin 2x$ Maximum values are at

$$\sin 2x = 1$$

$$2 \cdot x = \sin^{-1}(1) = 90^\circ, (90^\circ + 360^\circ)$$

$$x = 45^\circ, 225^\circ$$

Maximum Coordinates $\left(45^\circ, \frac{1}{2}\right), \left(225^\circ, \frac{1}{2}\right)$

Minimum values are at

$$\sin 2x = -1 \quad 2 \cdot x = \sin^{-1}(-1) = 270^\circ, (270^\circ + 360^\circ)$$

$$x = 135^\circ, 315^\circ$$

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Minimum Coordinates $\left(135^\circ, \frac{-1}{2}\right), \left(315^\circ, \frac{-1}{2}\right)$

Period is $2x = 360^\circ$

$$x = 180^\circ$$

(b) $3 \cdot \cos\left(\frac{1}{2}x\right)$ Maximum values are at

$$\cos\left(\frac{1}{2}x\right) = 1$$

$$\frac{1}{2} \cdot x = \cos^{-1}(1) = 0^\circ, 360^\circ$$

$$x = 0^\circ, 720^\circ$$

720° outside range!

Maximum Coordinate $(0^\circ, 3)$

Minimum values are at

$$\cos\left(\frac{1}{2}x\right) = -1$$

$$\frac{1}{2} \cdot x = \cos^{-1}(-1) = 180^\circ, (180^\circ + 360^\circ)$$

$$x = 360^\circ, 540^\circ$$

540° outside range!

Minimum Coordinate $(360^\circ, -3)$

Period is $\frac{1}{2}x = 360^\circ$ $x = 720^\circ$

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5. Simplify the following radians.

(a) $\frac{3\pi}{2} + \frac{\pi}{16}$

(b) $\left(\frac{\pi}{2} - \frac{\pi}{3}\right)$

(c) $3\pi - \frac{2\pi}{3}$

Solution

(a) $\frac{3\pi}{2} + \frac{\pi}{16} = \frac{(24\pi + \pi)}{16} = \frac{25\pi}{16}$

(b) $\frac{\pi}{2} - \frac{\pi}{3} = \frac{3\pi - 2\pi}{6} = \frac{\pi}{6}$

(c) $3\pi - \frac{2\pi}{3} = \frac{9\pi - 2\pi}{3} = \frac{7\pi}{3}$

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6. Find the maximum and minimum co-ordinates for the following functions and their periods.
Sketch the graphs between $0^\circ \leq x \leq 360^\circ$

(a) $\frac{1}{2} \cos(x - 60^\circ)$

(b) $4 \sin(x + 90^\circ)$

Solution

(a) $\frac{1}{2} \cdot \cos(x - 60^\circ)$ maximum values are at

$$\cos(x - 60^\circ) = 1$$

$$x - 60^\circ = \cos^{-1}(1) = 0^\circ, 360^\circ$$

$$x = (0^\circ + 60^\circ), (360^\circ + 60^\circ)$$

420° outside range!

Maximum coordinates $\left(60^\circ, \frac{1}{2}\right)$

minimum values are at

$$\cos(x - 60^\circ) = -1$$

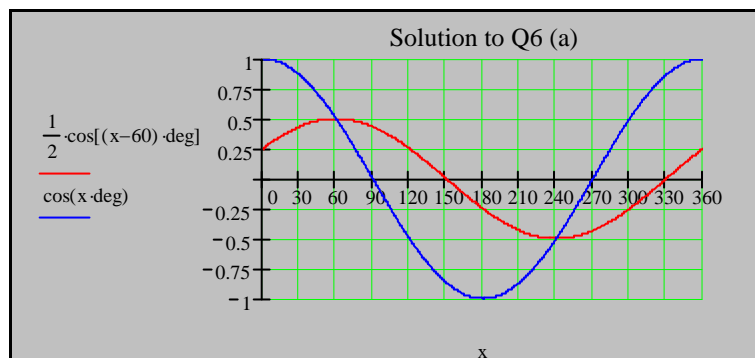
$$x - 60^\circ = \cos^{-1}(-1) = 180^\circ, (180^\circ + 360^\circ)$$

$$x = (180^\circ + 60^\circ), (540^\circ + 60^\circ)$$

540° outside range!

Minimum coordinate $\left(240^\circ, \frac{-1}{2}\right)$

Period is $x = 360^\circ$



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(b) $4 \cdot \sin(x + 90^\circ)$ maximum values are at

$$\sin(x + 90^\circ) = 1$$

$$x + 90^\circ = \sin^{-1}(1) = 90^\circ, (90^\circ + 360^\circ)$$

$$x = (90^\circ - 90^\circ), (90^\circ + 360^\circ - 90^\circ)$$

$$x = 0^\circ, 360^\circ$$

Maximum coordinates $(0^\circ, 4), (360^\circ, 4)$

minimum values are at

$$\sin(x + 90^\circ) = -1$$

$$x + 90^\circ = \sin^{-1}(-1) = 270^\circ, (270^\circ + 360^\circ)$$

$$x = (270^\circ - 90^\circ), (630^\circ - 90^\circ)$$

540° outside range!

Minimum coordinate $(180^\circ, -4)$

Period is $x = 360^\circ$

