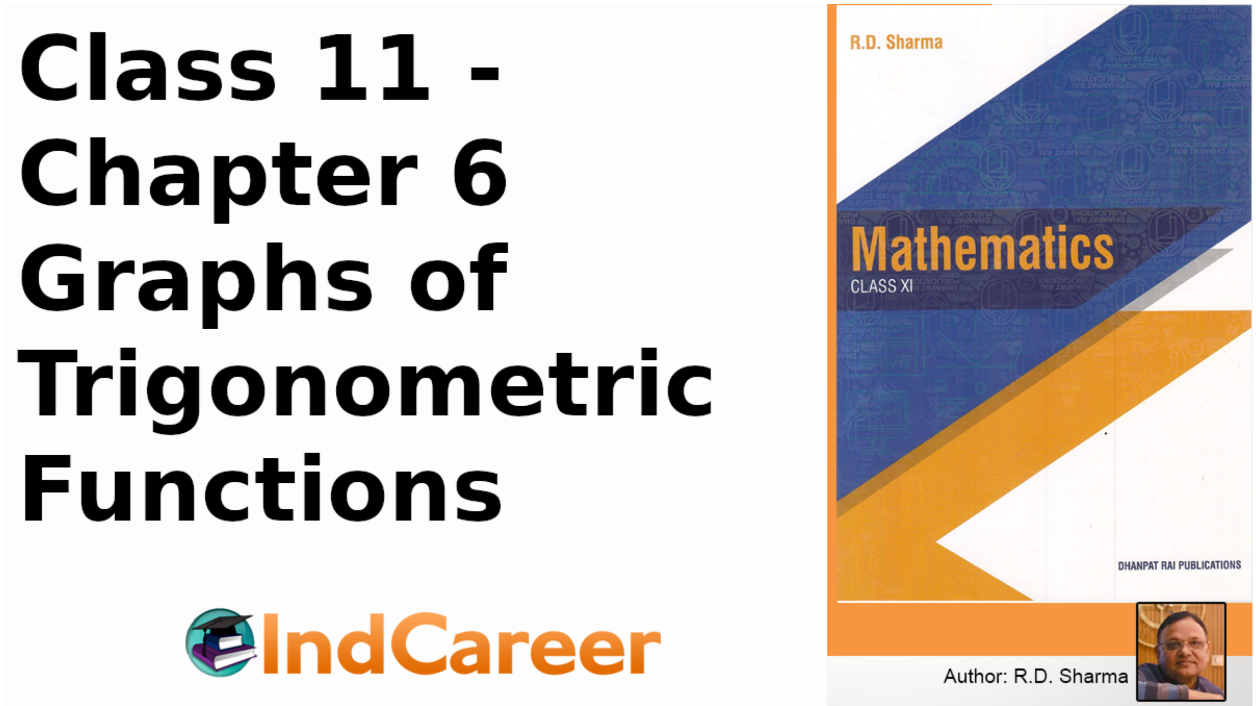

RD Sharma Solutions for Class 11 Maths Chapter 6–Graphs of Trigonometric Functions

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EXERCISE 6.1 PAGE NO: 6.5

1. Sketch the graphs of the following functions:

(i) f (x) = 2 sin x, 0 ≤ x ≤ π

(ii) g (x) = 3 sin (x – π/4), 0 ≤ x ≤ 5π/4

(iii) h (x) = 2 sin 3x, 0 ≤ x ≤ 2π/3

(iv) ϕ (x) = 2 sin (2x – π/3), 0 ≤ x ≤ 7π/3

(v) Ψ (x) = 4 sin 3 (x – π/4), 0 ≤ x ≤ 2π

(vi) θ (x) = sin (x/2 – π/4), 0 ≤ x ≤ 4π

(vii) u (x) = $\sin^2$ x, 0 ≤ x ≤ 2π υ (x) = |sin x|, 0 ≤ x ≤ 2π

(viii) f (x) = 2 sin πx, 0 ≤ x ≤ 2

Solution:

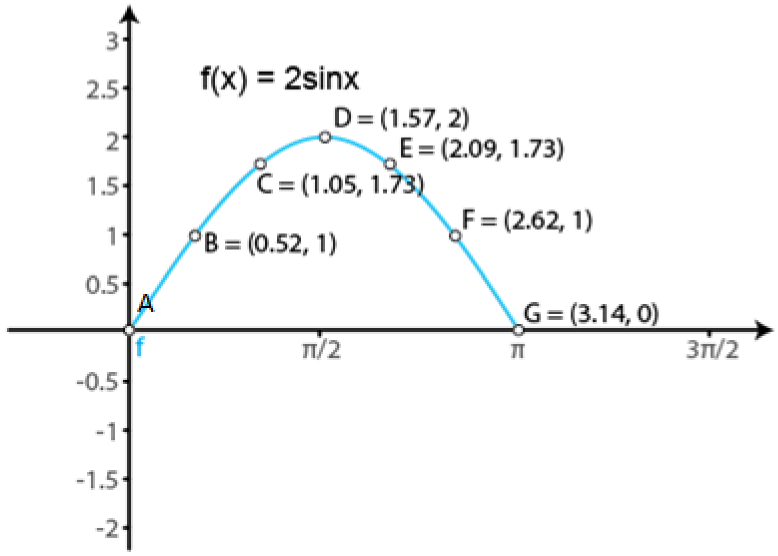
(i) f (x) = 2 sin x, 0 ≤ x ≤ π

We know that g (x) = sin x is a periodic function with period π.

So, f (x) = 2 sin x is a periodic function with period π. So, we will draw the graph of f (x) = 2 sin x in the interval [0, π]. The values of f (x) = 2 sin x at various points in [0, π] are listed in the following table:

x	0(A)	π/6 (B)	π/3 (C)	π/2 (D)	2π/3 (E)	5π/6 (F)	Π (G)
f (x) = 2 sin x	0	1	√3 = 1.73	2	√3 = 1.73	1	0

The required curve is:



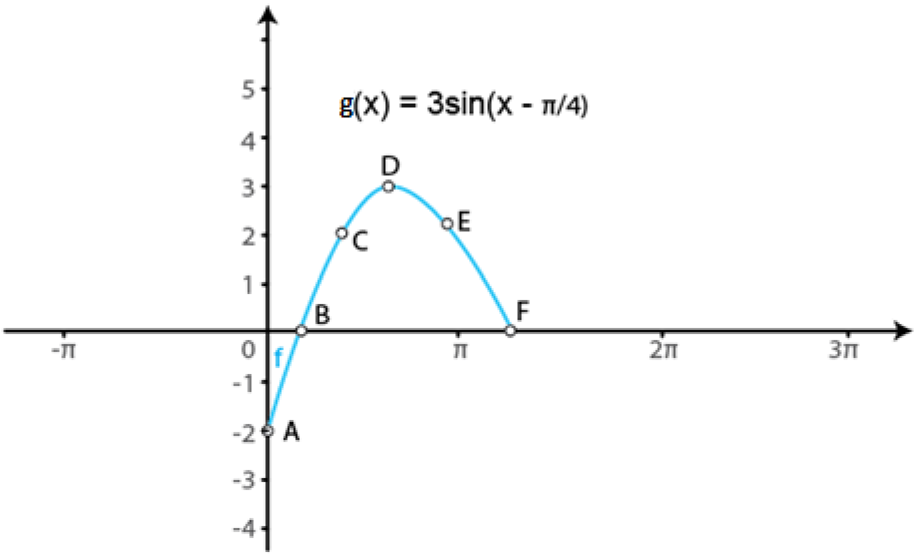
(ii) g (x) = 3 sin (x – π/4), 0 ≤ x ≤ 5π/4

We know that if f (x) is a periodic function with period T, then f (ax + b) is periodic with period T/|a|.

So, g (x) = 3 sin (x – π/4) is a periodic function with period π. So, we will draw the graph of g (x) = 3 sin (x – π/4) in the interval [0, 5π/4]. The values of g (x) = 3 sin (x – π/4) at various points in [0, 5π/4] are listed in the following table:

x	0(A)	π/4 (B)	π/2 (C)	3π/4 (D)	π (E)	5π/4 (F)
g (x) = 3 sin (x – π/4)	-3/√2 = -2.1	0	3/√2 = 2.12	3	3/√2 = 2.12	0

The required curve is:



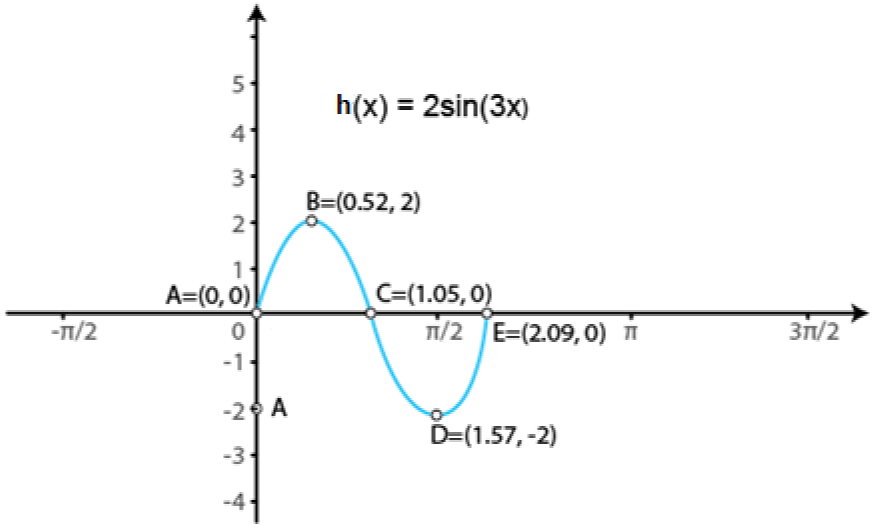
(iii) h (x) = 2 sin 3x, 0 ≤ x ≤ 2π/3

We know that g (x) = sin x is a periodic function with period 2π.

So, h (x) = 2 sin 3x is a periodic function with period 2π/3. So, we will draw the graph of h (x) = 2 sin 3x in the interval [0, 2π/3]. The values of h (x) = 2 sin 3x at various points in [0, 2π/3] are listed in the following table:

x	0 (A)	π/6 (B)	π/3 (C)	π/2 (D)	2π/3 (E)
h (x) = 2 sin 3x	0	2	0	-2	0

The required curve is:



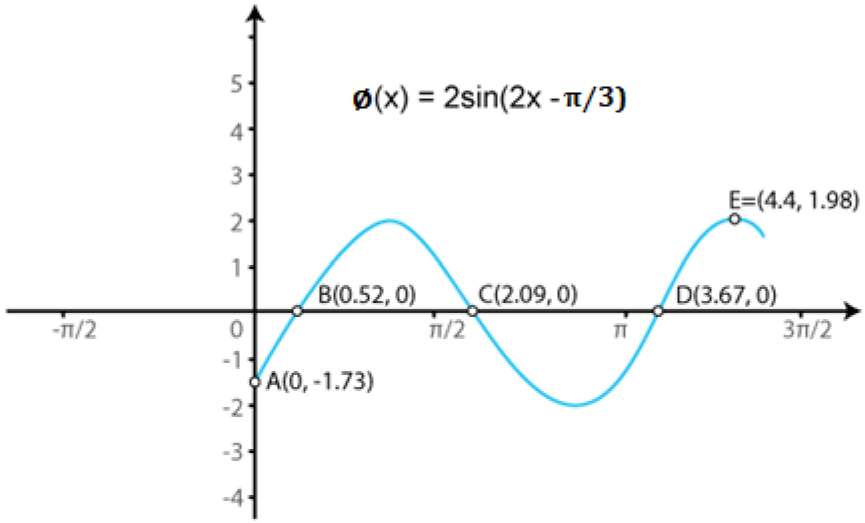
(iv) ϕ (x) = 2 sin (2x – π/3), 0 ≤ x ≤ 7π/3

We know that if f(x) is a periodic function with period T, then f (ax + b) is periodic with period T/|a|.

So, ϕ (x) = 2 sin (2x – π/3) is a periodic function with period π. So, we will draw the graph of ϕ (x) = 2 sin (2x – π/3), in the interval [0, 7π/5]. The values of ϕ (x) = 2 sin (2x – π/3), at various points in [0, 7π/5] are listed in the following table:

x	0 (A)	π/6 (B)	2π/3 (C)	7π/6 (D)	7π/5 (E)
ϕ (x) = 2 sin (2x – π/3)	-√3 = -1.73	0	0	0	1.98

The required curve is:



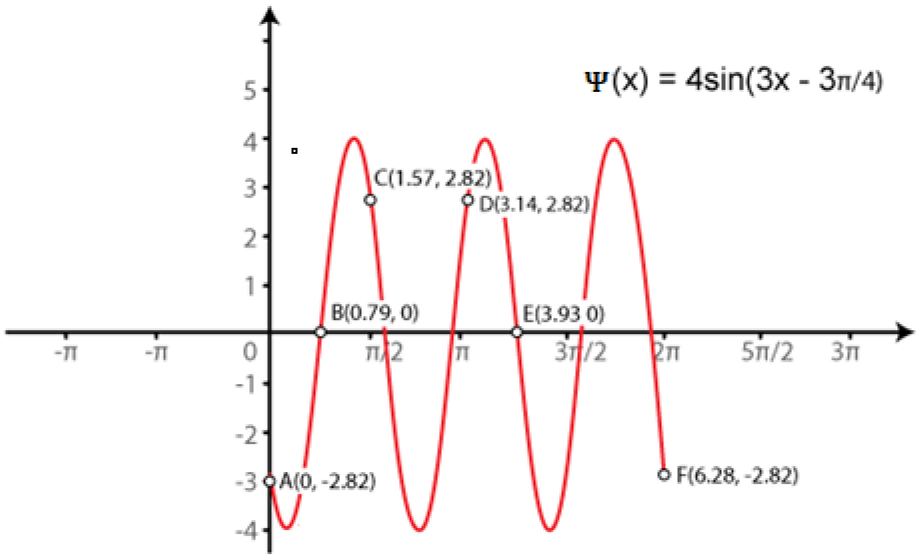
(v) Ψ (x) = 4 sin 3 (x – π/4), 0 ≤ x ≤ 2π

We know that if f(x) is a periodic function with period T, then f (ax + b) is periodic with period T/|a|.

So, Ψ (x) = 4 sin 3 (x – π/4) is a periodic function with period 2π. So, we will draw the graph of Ψ (x) = 4 sin 3 (x – π/4) in the interval [0, 2π]. The values of Ψ (x) = 4 sin 3 (x – π/4) at various points in [0, 2π] are listed in the following table:

x	0 (A)	π/4 (B)	π/2 (C)	π (D)	5π/4 (E)	2π (F)
Ψ (x) = 4 sin 3 (x – π/4)	-2√2 = -2.82	0	2√2 = 2.82	0	1.98	-2√2 = -2.82

The required curve is:



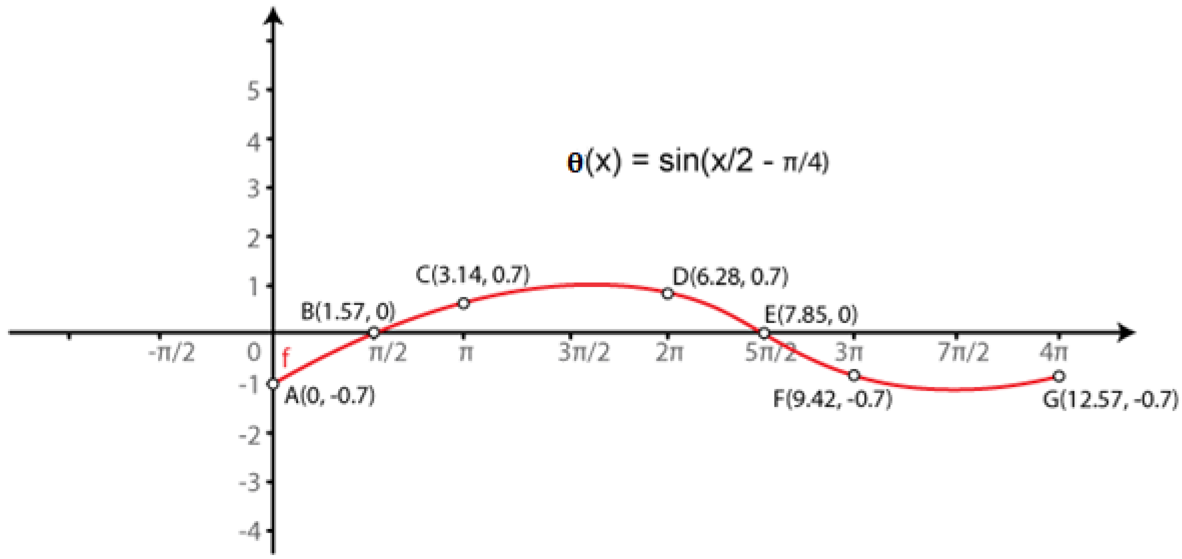
(vi) θ (x) = sin (x/2 – π/4), 0 ≤ x ≤ 4π

We know that if f(x) is a periodic function with period T, then f (ax + b) is periodic with period T/|a|.

So, θ (x) = sin (x/2 – π/4) is a periodic function with period 4π. So, we will draw the graph of θ (x) = sin (x/2 – π/4) in the interval [0, 4π]. The values of θ (x) = sin (x/2 – π/4) at various points in [0, 4π] are listed in the following table:

x	0 (A)	π/2 (B)	π (C)	2π (D)	5π/2 (E)	3π (F)	4π (G)
θ (x) = sin (x/2 – π/4)	-1/√2 = -0.7	0	1/√2 = 0.7	1/√2 = 0.7	0	-1/√2 = -0.7	-1/√2 = -0.7

The required curve is:



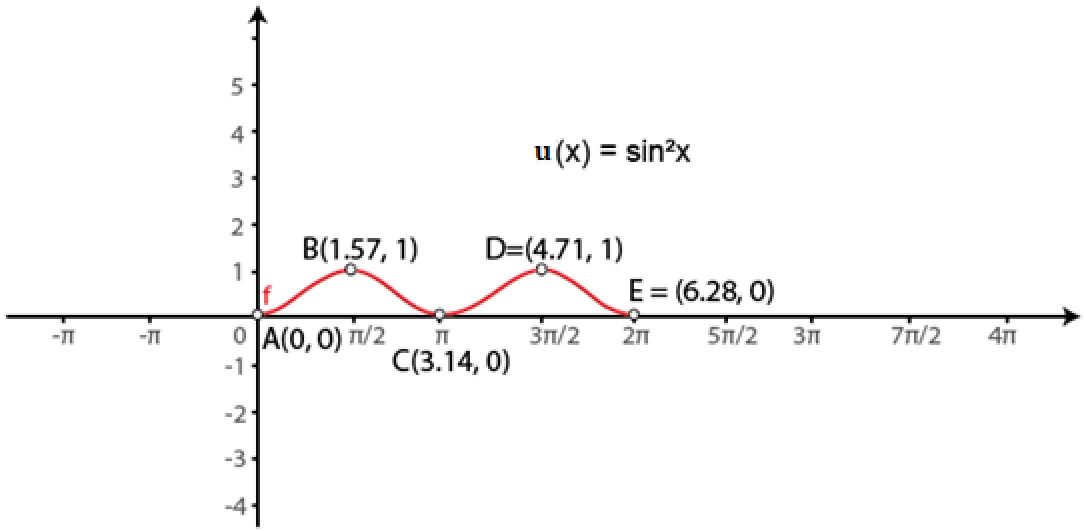
(vii) u (x) = $\sin^2$ x, 0 ≤ x ≤ 2π u (x) = |sin x|, 0 ≤ x ≤ 2π

We know that g (x) = sin x is a periodic function with period π.

So, u (x) = $\sin^2$ x is a periodic function with period 2π. So, we will draw the graph of u (x) = $\sin^2$ x in the interval [0, 2π]. The values of u (x) = $\sin^2$ x at various points in [0, 2π] are listed in the following table:

x	0 (A)	π/2 (B)	Π (C)	3π/2 (D)	2π (E)
u (x) = $\sin^2$ x	0	1	0	1	0

The required curve is:



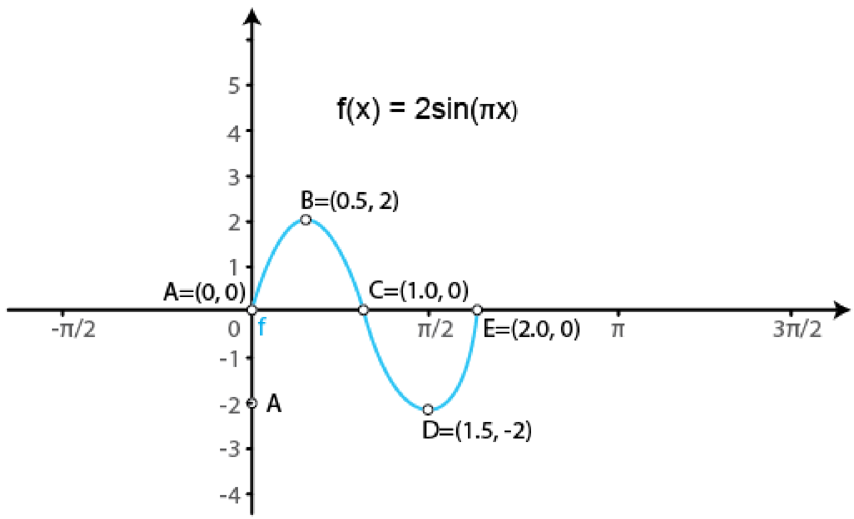
(viii) f (x) = 2 sin πx, 0 ≤ x ≤ 2

We know that g (x) = sin x is a periodic function with period 2π.

So, f (x) = 2 sin πx is a periodic function with period 2. So, we will draw the graph of f (x) = 2 sin πx in the interval [0, 2]. The values of f (x) = 2 sin πx at various points in [0, 2] are listed in the following table:

x	0 (A)	1/2 (B)	1 (C)	3/2 (D)	2 (E)
f (x) = 2 sin πx	0	2	0	-2	0

The required curve is:



2. Sketch the graphs of the following pairs of functions on the same axes:

(i) f (x) = sin x, g (x) = sin (x + π/4)

(ii) f (x) = sin x, g (x) = sin 2x

(iii) f (x) = sin 2x, g (x) = 2 sin x

(iv) f (x) = sin x/2, g (x) = sin x

Solution:

(i) f (x) = sin x, g (x) = sin (x + π/4)

We know that the functions f (x) = sin x and g (x) = sin (x + π/4) are periodic functions with periods 2π and 7π/4.

The values of these functions are tabulated below:

Values of f (x) = sin x in [0, 2π]

x	0	π/2	π	3π/2	2π
f (x) = sin x	0	1	0	-1	0

Values of g (x) = sin (x + π/4) in [0, 7π/4]

x	0	π/4	3π/4	5π/4	7π/4
g (x) = sin (x + π/4)	1/√2 = 0.7	1	0	-1	0

The required curve is:

(ii) f (x) = sin x, g (x) = sin 2x

We know that the functions f(x) = sin x and g (x) = sin 2x are periodic functions with periods 2π and π.

The values of these functions are tabulated below:

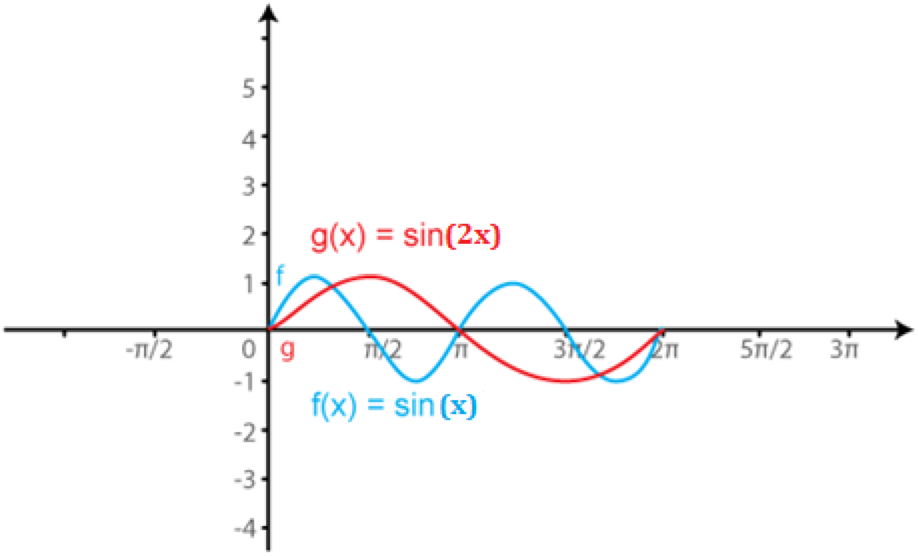
Values of f (x) = sin x in [0, 2π]

x	0	π/2	π	3π/2	2π
f (x) = sin x	0	1	0	-1	0

Values of g (x) = sin (2x) in [0, π]

x	0	π/4	π/2	3π/4	π	5π/4	3π/2	7π/4	2π
g (x) = sin (2x)	0	1	0	-1	0	1	0	-1	0

The required curve is:



(iii) f (x) = sin 2x, g (x) = 2 sin x

We know that the functions f(x) = sin 2x and g (x) = 2 sin x are periodic functions with periods π and π.

The values of these functions are tabulated below:

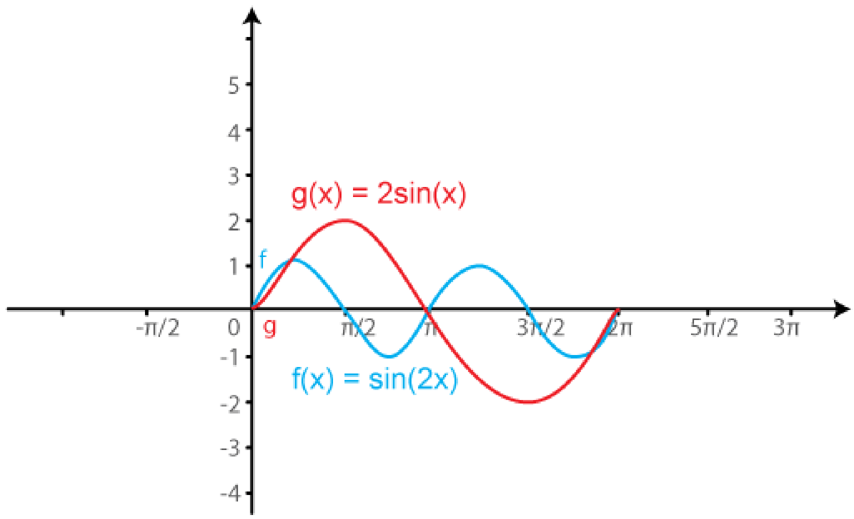
Values of f (x) = sin (2x) in [0, π]

x	0	π/4	π/2	3π/4	π	5π/4	3π/2	7π/4	2π
f (x) = sin (2x)	0	1	0	-1	0	1	0	-1	0

Values of g (x) = 2 sin x in [0, π]

x	0	π/2	π	3π/2	2π
g (x) = 2 sin x	0	1	0	-1	0

The required curve is:



(iv) f (x) = sin x/2, g (x) = sin x

We know that the functions f(x) = sin x/2 and g (x) = sin x are periodic functions with periods π and 2π.

The values of these functions are tabulated below:

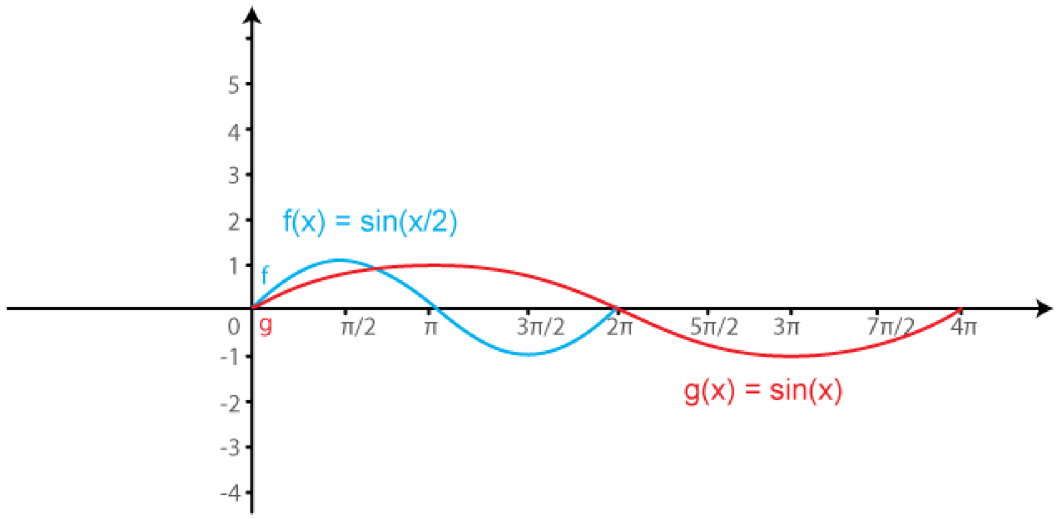
Values of f (x) = sin x/2 in [0, π]

x	0	π	2π	3π	4π
f (x) = sin x/2	0	1	0	-1	0

Values of g (x) = sin (x) in [0, 2π]

x	0	π/2	π	3π/2	2π	5π/2	3π	7π/2	4π
g (x) = sin (x)	0	1	0	-1	0	1	0	-1	0

The required curve is:



EXERCISE 6.2 PAGE NO: 6.8

1. Sketch the graphs of the following trigonometric functions:

(i) f (x) = cos (x – π/4)

(ii) g (x) = cos (x + π/4)

(iii) h (x) = $\cos^2$ 2x

(iv) ϕ (x) = 2 cos (x – π/6)

(v) ψ (x) = cos (3x)

(vi) u (x) = $\cos^2$ x/2

(vii) f (x) = cos πx

(viii) g (x) = cos 2π x

Solution:

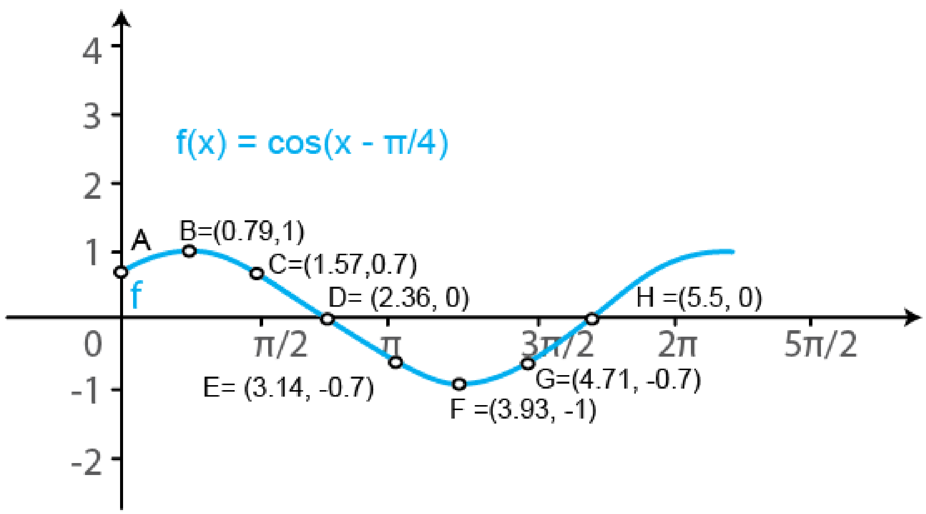
(i) f (x) = cos (x – π/4)

We know that g (x) = cos x is a periodic function with period 2π.

So, f (x) = cos (x – π/4) is a periodic function with period π. So, we will draw the graph of f (x) = cos (x – π/4) in the interval [0, π]. The values of f (x) = cos (x – π/4) at various points in [0, π] are listed in the following table:

x	0 (A)	π/4 (B)	π/2 (C)	3π/4 (D)	π (E)	5π/4 (F)	3π/2 (G)	7π/4 (H)
f (x) = cos (x – π/4)	1/√2 = 0.7	1	1/√2 = 0.7	0	-1/√2 = -0.7	-1	-1/√2 = -0.7	0

The required curve is:



(ii) g (x) = cos (x + π/4)

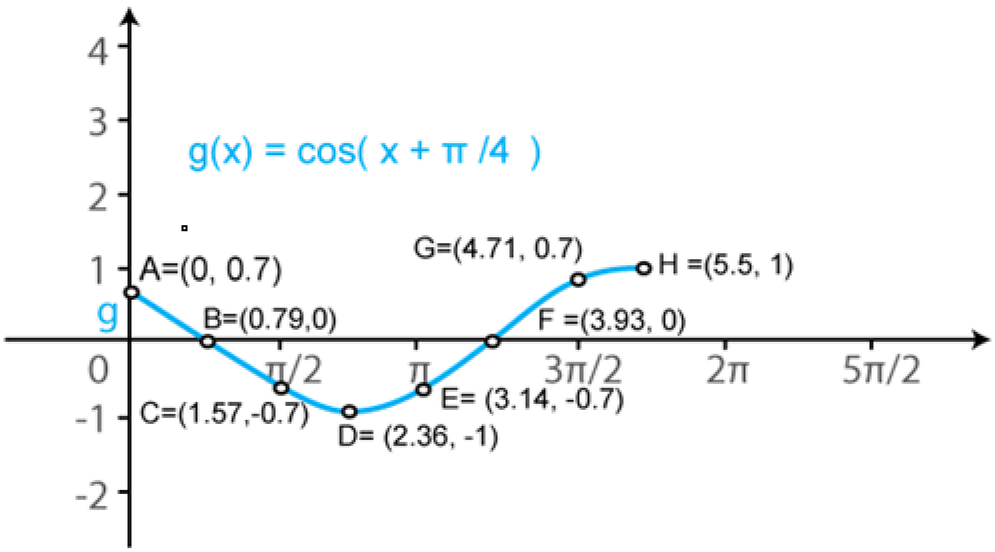
We know that f (x) = cos x is a periodic function with period 2π.

So, g (x) = cos (x + π/4) is a periodic function with period π. So, we will draw the graph of g (x) = cos (x + π/4) in the interval [0, π]. The values of g (x) = cos (x + π/4) at various points in [0, π] are listed in the following table:

x	0 (A)	π/4 (B)	π/2 (C)	3π/4 (D)	π (E)	5π/4 (F)	3π/2 (G)	7π/4 (H)

g (x) = cos (x + π/4)	1/√2 = 0.7	0	-1/√2 = -0.7	-1	-1/√2 = -0.7	0	1/√2 = 0.7	1

The required curve is:



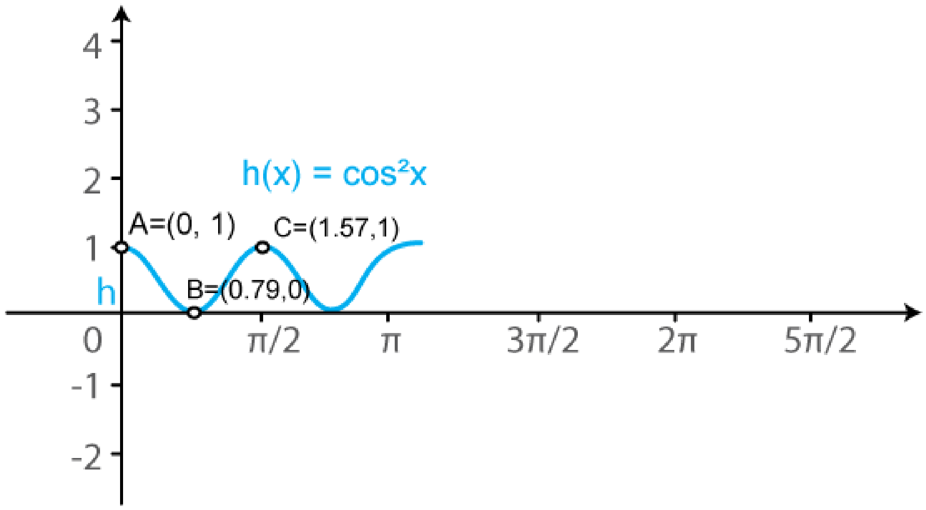
(iii) h (x) = $\cos^2 2x$

We know that f (x) = cos x is a periodic function with period 2π.

So, h (x) = $\cos^2 2x$ is a periodic function with period π. So, we will draw the graph of h (x) = $\cos^2 2x$ in the interval [0, π]. The values of h (x) = $\cos^2 2x$ at various points in [0, π] are listed in the following table:

x	0 (A)	π/4 (B)	π/2 (C)	3π/4 (D)	π (E)	5π/4 (F)	3π/2 (G)
h (x) = $\cos^2 2x$	1	0	1	0	1	0	1

The required curve is:



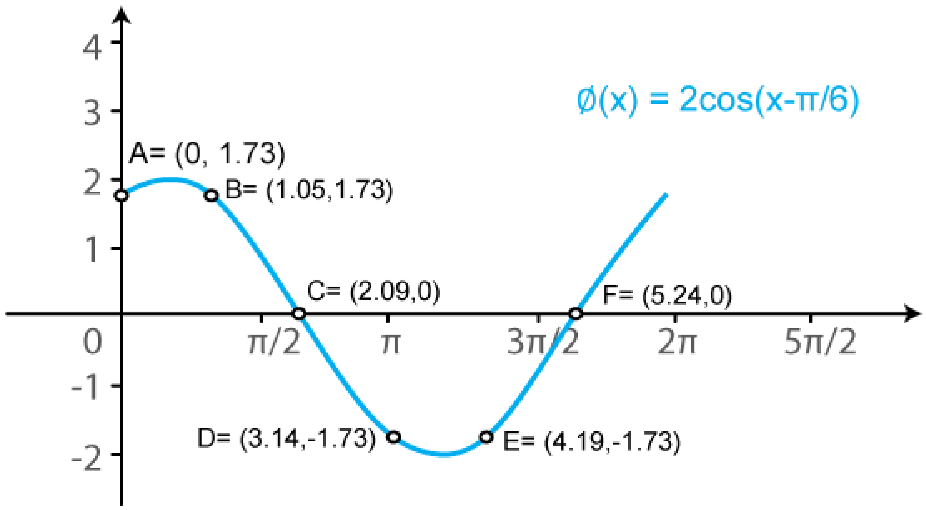
(iv) ϕ (x) = 2 cos (x – π/6)

We know that f (x) = cos x is a periodic function with period 2π.

So, ϕ (x) = 2cos (x – π/6) is a periodic function with period π. So, we will draw the graph of ϕ (x) = 2cos (x – π/6) in the interval [0, π]. The values of ϕ (x) = 2cos (x – π/6) at various points in [0, π] are listed in the following table:

x	0 (A)	π/3 (B)	2π/3 (C)	π (D)	4π/3 (E)	5π/3 (F)
ϕ (x) = 2 cos (x – π/6)	√3 = 1.73	√3 = 1.73	0	-√3 = -1.73	-√3 = -1.73	0

The required curve is:



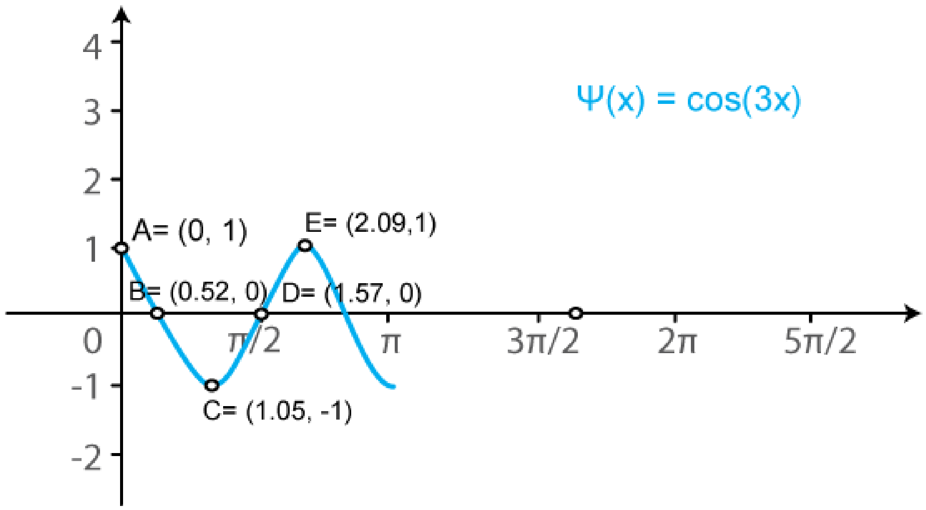
(v) ψ (x) = cos (3x)

We know that f (x) = cos x is a periodic function with period 2π.

So, ψ (x) = cos (3x) is a periodic function with period 2π/3. So, we will draw the graph of ψ (x) = cos (3x) in the interval [0, 2π/3]. The values of ψ (x) = cos (3x) at various points in [0, 2π/3] are listed in the following table:

x	0 (A)	π/6 (B)	π/3 (C)	π/2 (D)	2π/3 (E)	5π/6 (F)
ψ (x) = cos (3x)	1	0	-1	0	1	0

The required curve is:



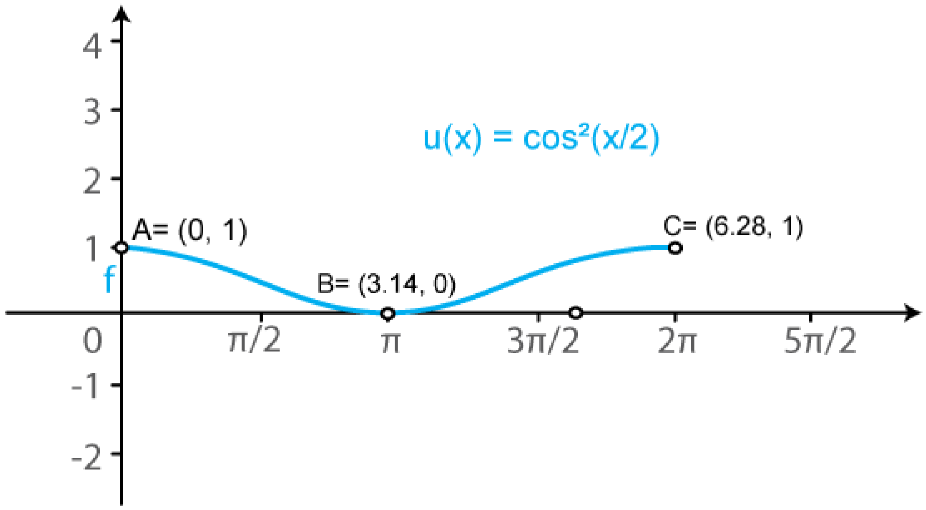
(vi) u (x) = $\cos^2 x/2$

We know that f (x) = cos x is a periodic function with period 2π.

So, u (x) = $\cos^2 (x/2)$ is a periodic function with period π. So, we will draw the graph of u (x) = $\cos^2 (x/2)$ in the interval [0, π]. The values of u (x) = $\cos^2 (x/2)$ at various points in [0, π] are listed in the following table:

x	0 (A)	π (B)	2π (C)	3π (D)
u (x) = $\cos^2 x/2$	1	0	1	0

The required curve is:



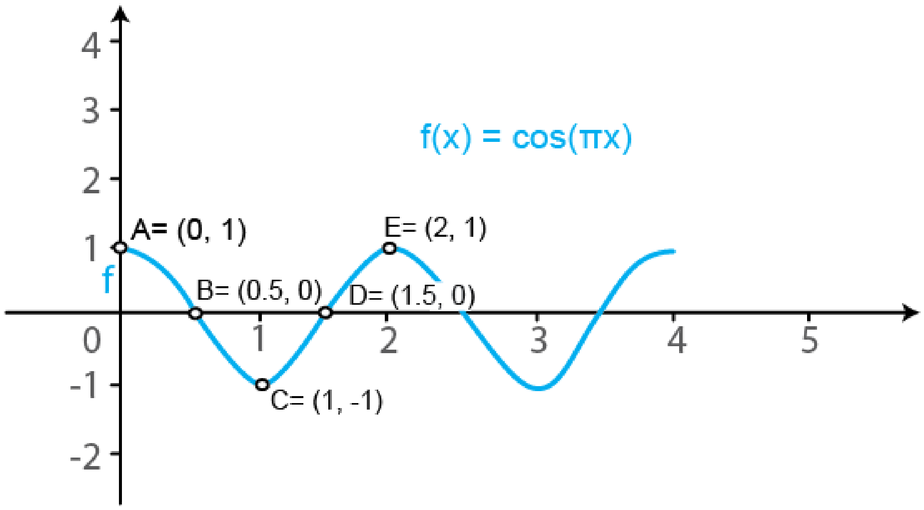
(vii) f (x) = cos πx

We know that g (x) = cos x is a periodic function with period 2π.

So, f (x) = cos (πx) is a periodic function with period 2. So, we will draw the graph of f (x) = cos (πx) in the interval [0, 2]. The values of f (x) = cos (πx) at various points in [0, 2] are listed in the following table:

x	0 (A)	1/2 (B)	1 (C)	3/2 (D)	2 (E)	5/2 (F)
f (x) = cos πx	1	0	-1	0	1	0

The required curve is:



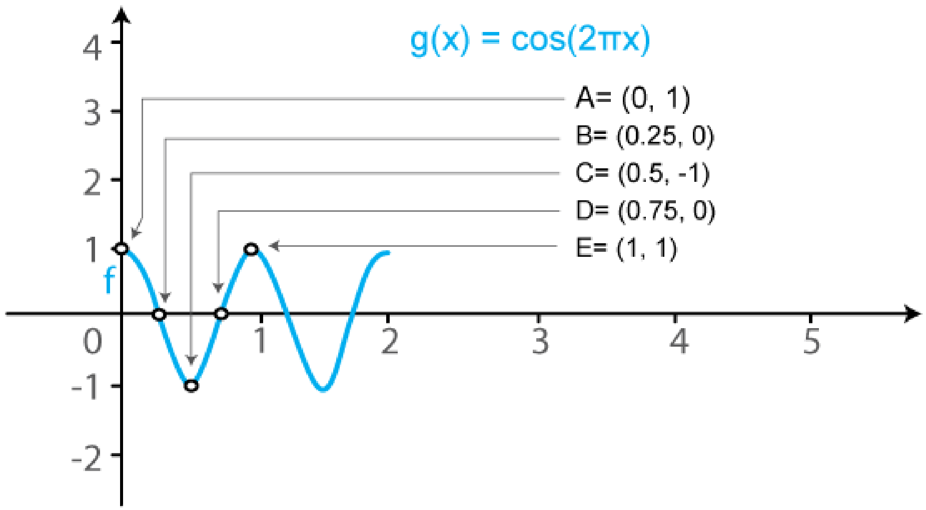
(viii) g (x) = cos 2π x

We know that f (x) = cos x is a periodic function with period 2π.

So, g (x) = cos (2πx) is a periodic function with period 1. So, we will draw the graph of g (x) = cos (2πx) in the interval [0, 1]. The values of g (x) = cos (2πx) at various points in [0, 1] are listed in the following table:

x	0 (A)	1/4 (B)	1/2 (C)	3/4 (D)	1 (E)	5/4 (F)	3/2 (G)	7/4 (H)	2
g (x) = cos 2π x	1	0	-1	0	1	0	-1	0	1

The required curve is:



2. Sketch the graphs of the following curves on the same scale and the same axes:

(i) y = cos x and y = cos (x – π/4)

(ii) y = cos 2x and y = cos (x – π/4**)**

(iii) y = cos x and y = cos x/2

(iv) y = cos^2 x and y = cos x

Solution:

(i) y = cos x and y = cos (x – π/4)

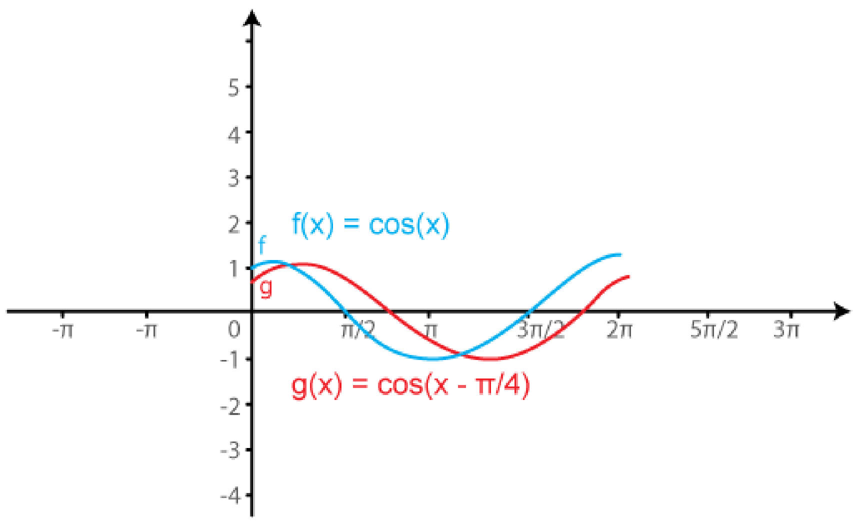
We know that the functions y = cos x and y = cos (x – π/4) are periodic functions with periods π and π.

The values of these functions are tabulated below:

x	0	π/4	π/2	3π/4	π	5π/4	3π/2	7π/4
y = cos x	1	1/√2 = 0.7	0	-1/√2 = -0.7	-1	-1/√2 = -0.7	0	1

y = cos (x – π/4)	1/√2 = 0.7	1	1/√2 = 0.7	0	-1/√2 = -0.7	-1	-1/√2 = -0.7	0

The required curve is:



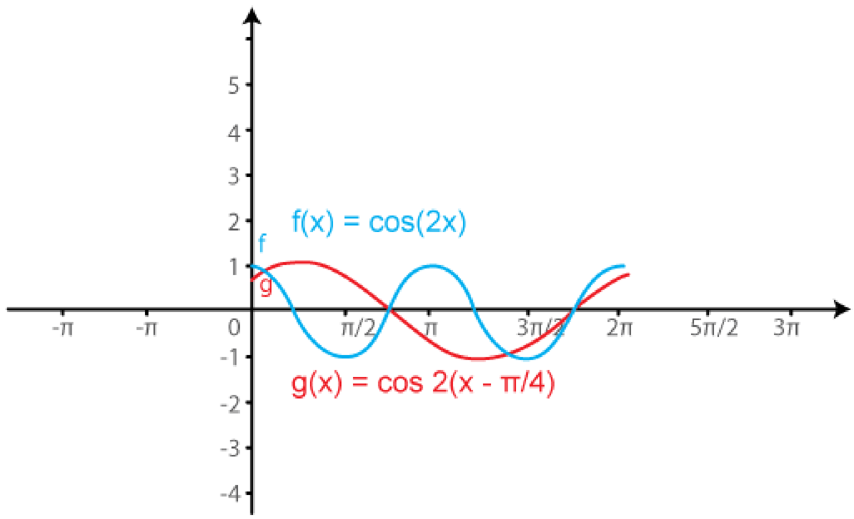
(ii) y = cos 2x and y = cos 2(x – π/4)

We know that the functions y = cos 2x and y = cos 2(x – π/4) are periodic functions with periods π and π.

The values of these functions are tabulated below:

x	0	π/4	π/2	3π/4	π	5π/4	3π/2	7π/4
y = cos x	1	0	-1	0	1	0	-1	0
y = cos 2 (x – π/4)	0	1	0	-1	0	1	0	-1

The required curve is:



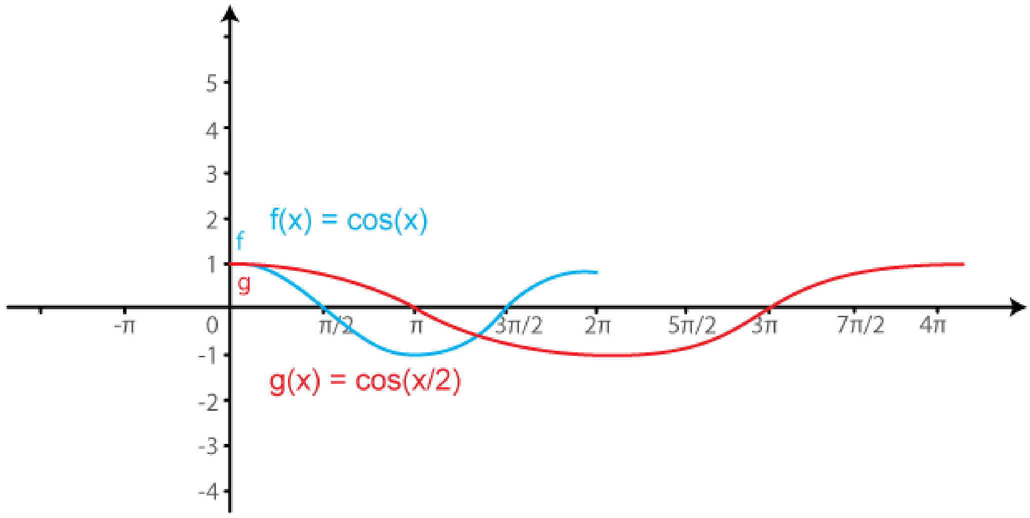
(iii) y = cos x and y = cos x/2

We know that the functions y = cos x and y = cos (x/2) are periodic functions with periods π and π.

The values of these functions are tabulated below:

x	0	π/2	π	3π/2	2π
y = cos x	1	0	-1	0	1
y = cos x/2	1	1/√2 = 0.7	0	-1/√2 = -0.7	-1

The required curve is:



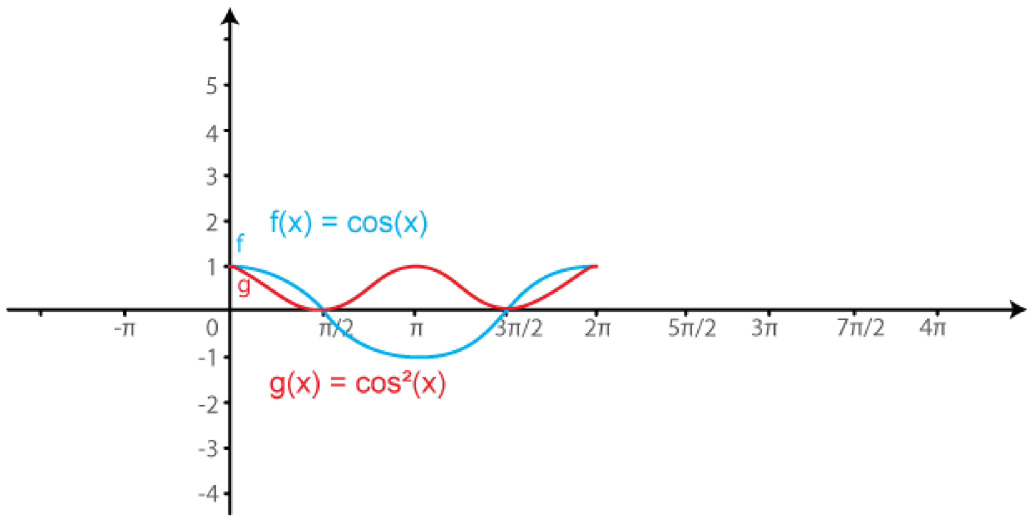
(iv) y = $\cos^2$ x and y = cos x

We know that the functions y = $\cos^2$ x and y = cos x are periodic functions with period 2π.

The values of these functions are tabulated below:

x	0	π/2	π	3π/2	2π
y = $\cos^2$ x	1	0	1	0	1
y = cos x	1	0	-1	0	1

The required curve is:



EXERCISE 6.3 PAGE NO: 6.13

Sketch the graphs of the following functions:

1. f (x) = 2 cosec πx

Solution:

We know that f (x) = cosec x is a periodic function with period 2π.

So, f (x) = 2 cosec (πx) is a periodic function with period 2. So, we will draw the graph of f (x) = 2 cosec (πx) in the interval [0, 2]. The values of f (x) = 2 cosec (πx) at various points in [0, 2] are listed in the following table:

x	0 (A)	1/2 (B)	1 (C)	-1 (D)	3/2 (E)	-2 (F)	2 (G)	5/2 (H)
f (x) = 2 cosec (πx)	∞	2	∞	-∞	-2	-∞	∞	2

The required curve is:

2. f (x) = 3 sec x

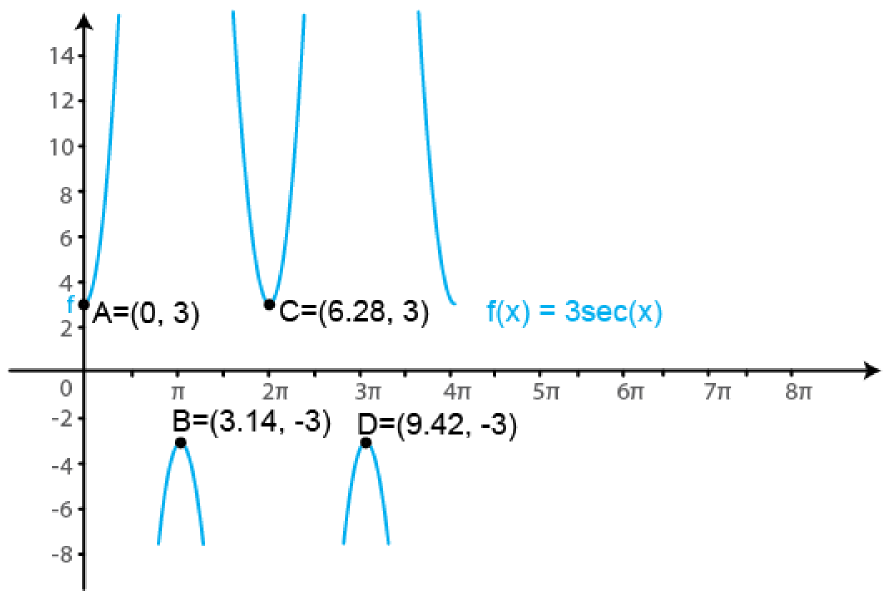
Solution:

We know that f (x) = sec x is a periodic function with period π.

So, f (x) = 3 sec (x) is a periodic function with period π. So, we will draw the graph of f (x) = 3 sec (x) in the interval [0, π]. The values of f (x) = 3 sec (x) at various points in [0, π] are listed in the following table:

x	0 (A)	π/2 (B)	-π/2 (C)	π (D)	-3π/2 (E)	3π/2 (F)	2π (G)	5π/2 (H)
f (x) = sec x	3	∞	-∞	-3	-∞	∞	3	∞

The required curve is:



3. f (x) = cot 2x

Solution:

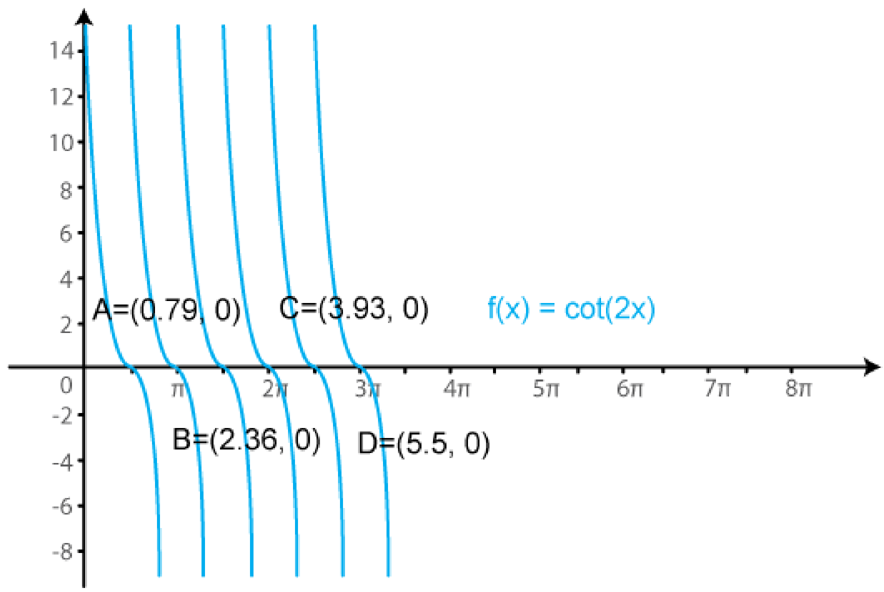
We know that f (x) = cot x is a periodic function with period π.

So, f (x) = cot (2x) is a periodic function with period π. So, we will draw the graph of f (x) = cot (2x) in the interval [0, π]. The values of f (x) = cot (2x) at various points in [0, π] are listed in the following table:

x	0 (A)	π/4 (B)	-π/2 (C)	π/2 (D)	3π/4 (E)	-π (F)

f (x) = cot x	→∞	0	-∞	→∞	0	-∞

The required curve is:



4. f (x) = 2 sec πx

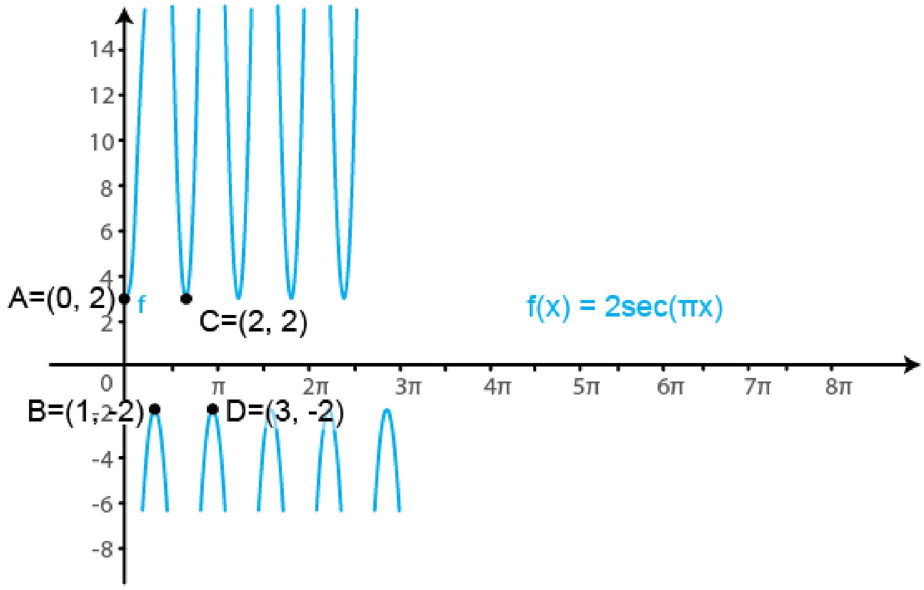
Solution:

We know that f (x) = sec x is a periodic function with period π.

So, f (x) = 2 sec (πx) is a periodic function with period 1. So, we will draw the graph of f (x) = 2 sec (πx) in the interval [0, 1]. The values of f (x) = 2 sec (πx) at various points in [0, 1] are listed in the following table:

x	0	1/2	-1/2	1	-3/2	3/2	2
f (x) = 2 sec (πx)	2	∞	→-∞	-2	-∞	∞	2

The required curve is:



5. f (x) = tan^2 x

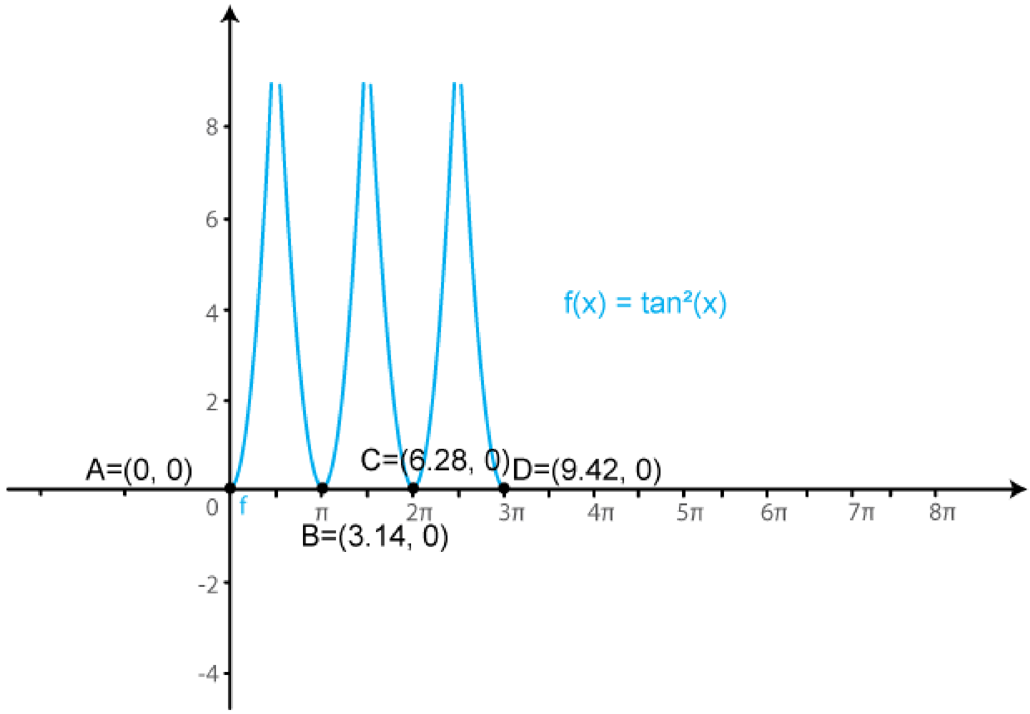
Solution:

We know that f (x) = tan x is a periodic function with period π.

So, f (x) = tan^2 (x) is a periodic function with period π. So, we will draw the graph of f (x) = tan^2 (x) in the interval [0, π]. The values of f (x) = tan^2 (x) at various points in [0, π] are listed in the following table:

x	0 (A)	π/2 (B)	π/2 (C)	π (D)	3π/2 (E)	3π/2 (F)	2 π
f (x) = tan^2 (x)	0	∞	→∞	0	∞	→∞	0

The required curve is:



f(x) = tan²(x)
A=(0, 0)
B=(3.14, 0)
C=(6.28, 0)
D=(9.42, 0)
8
6
4
2
0
-2
-4
f
π
2π
3π
4π
5π
6π
7π
8π

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About RD Sharma

RD Sharma i*sn'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.