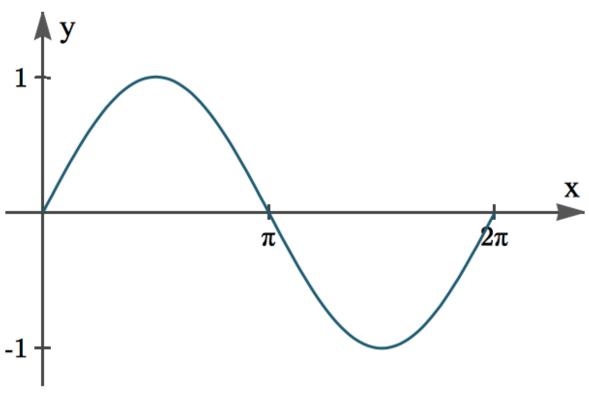
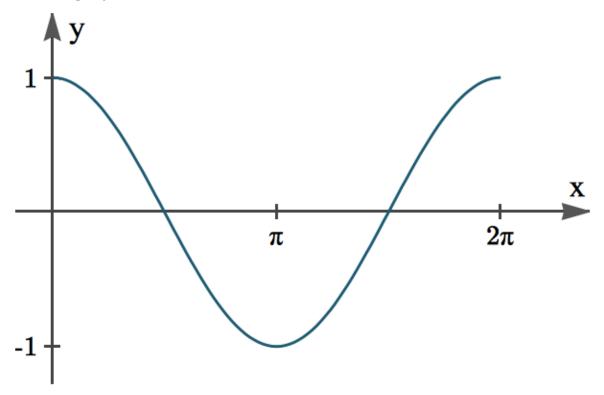


Trigonometric transformation

Sine graph



Cosine graph



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Transformation

$$A f(B(x+C)) + D$$

A: Affects amplitude

B: Affects period

C: Affects horizontal translation

D: Affects vertical translation

The **period** for sine and cosine function is 2π .

Amplitude is half of the vertical distance.



Α

A f(x)

A is amplitude.

A multiplies the y-coordinates.

$$A = \frac{y_{max} - y_{min}}{2}$$

1. Sketch the graph of the followings.

(a)
$$y = 2 \sin x$$

(b)
$$y = 0.5 \sin x$$



B

f(Bx)

B affects the period.

New period =
$$\frac{2\pi}{B}$$

- 1. Sketch the graph of the followings.
- (a) sin 2x

(b)
$$\sin \frac{3}{2} x$$



C

$$f(x + C)$$

C is the horizontal shift.

If C is **Positive**, shift **Left** e.g. f(x + 2) means shift Left by 2.

It C is **Negative**, shift **Right** e.g. f(x-1) means shift Right by 1.

1. Sketch the graph of the followings. (a) $\sin (x + 50^{\circ})$

(b)
$$\sin(x-\pi)$$



D

$$f(x) + D$$

D is the vertical shift.

If **D** is Positive, shift **Up**e.g. f(x) + 1 means shift Up by 1.

It **D** is Negative, shift **Down** e.g. f(x) - 3 means shift Down by 3.

1. Sketch the graph of the followings.

(a)
$$\sin x + 2$$

(b) $\sin x - 1$

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(c) $\cos x + 3$

(d) $\cos x - 2$



Exercise

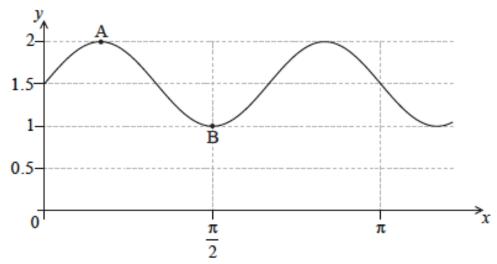
Paper 1

- 1. \bigcirc $f(x) = \cos 2x$ and $g(x) = 2x^2 1$.
- (a) Find $f\left(\frac{\pi}{2}\right)$.
- (b) Find $(g \circ f) \left(\frac{\pi}{2}\right)$.
- (c) Given that $(g \circ f)(x)$ can be written a cos (kx), find the value of k, $k \in \mathbb{Z}$.



Paper 2

1. The following diagram shows part of the graph of $y=p \sin(qx)+r$.



The point $A\left(\frac{\pi}{6},2\right)$ is a maximum point and the point $B\left(\frac{\pi}{2},1\right)$ is a maximum point.

Find the value of

- (a) p
- (b) r
- (c) q



2. The depth of water in a port is modelled by the function $d(t) = p \cos qt + 7.5$, for $0 \le t \le 12$, where t is the number of hours after high tide.

At high tide, the depth is 9.7 metres.

At low tide, which is 7 hours later, the depth is 5.3 metres.

- (a) Find the value of p.
- (b) Find the value of q.
- (c) Use the model to find the depth of the water 10 hours after high tide.