→ the y-values of the key points will be multiplied by 2

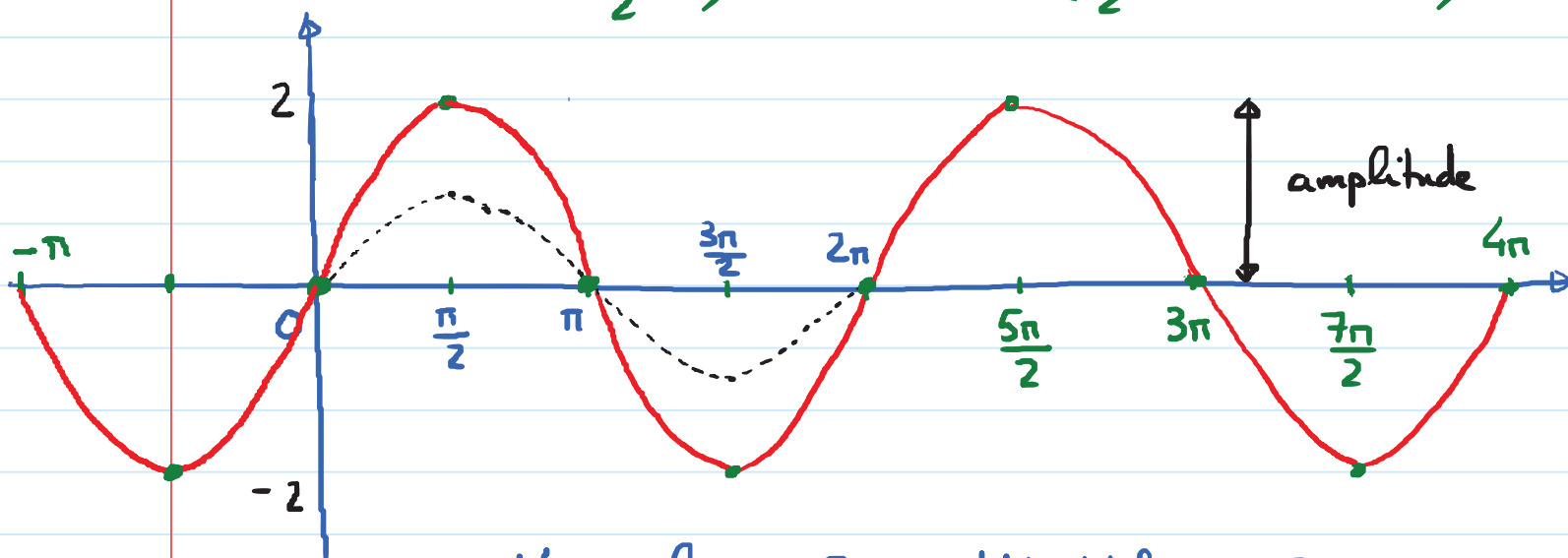<span style="color:red">Intercept          Max     Intercept     Min   Intercept</span>

<span style="color:green">$(0, 0)$          $(\frac{\pi}{2}, 2)$     $(\pi, 0)$     $(\frac{3\pi}{2}, -2)$ $(2\pi, 0)$</span>



Max value $= 2$ , Min Value $= -2$

$$\frac{Max - Min}{2} = \frac{2 - (-2)}{2} = 2 \to amplitude.$$

<span style="color:green">③ Graphs of functions of the form $y = a \sin(bx)$</span>

<span style="color:green">or $y = a \cos(bx)$ ( a, b are constants, assume</span>
<span style="color:green">b > 0)</span>

<u>Period</u>: The period of $y = a \sin(bx)$ or $y = a \cos(bx)$

$$\boxed{\text{Period} = \frac{2\pi}{b}}$$

**Why?**   $y = a \sin(\boxed{bx})$ ⟵ angle

When angle $= 0$ to angle $= 2\pi$ ⟶ 1 period

$$bx = 0 \longrightarrow bx = 2\pi$$
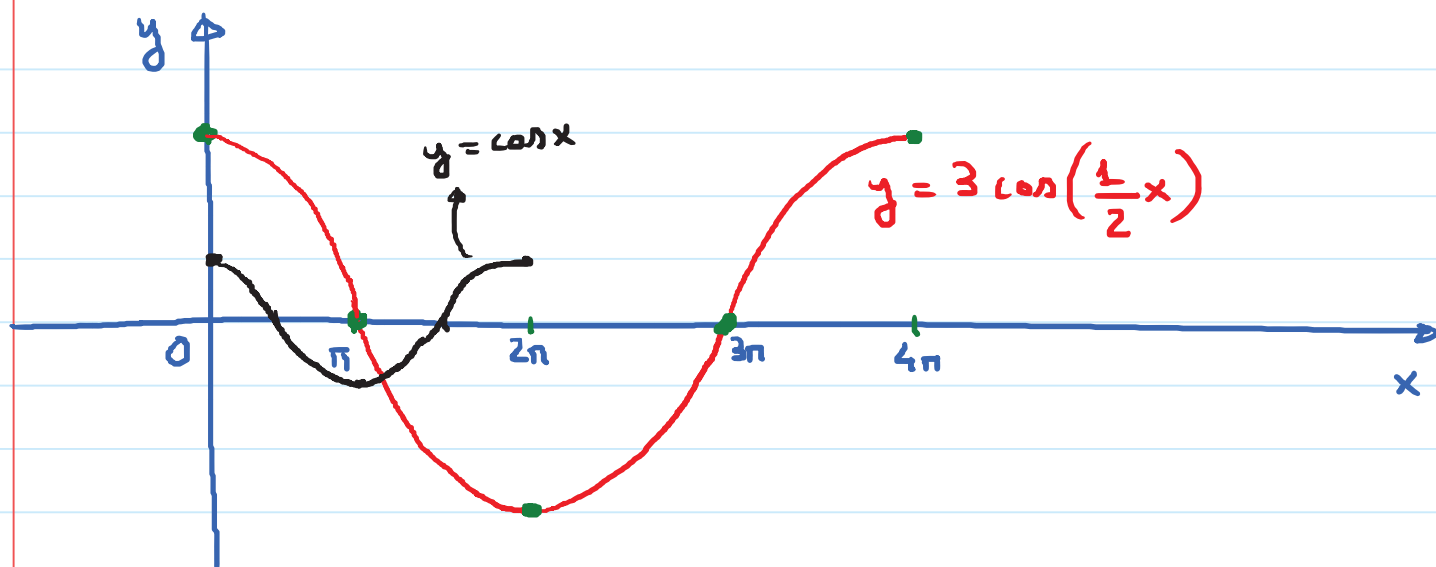$$x = 0 \longrightarrow x = \frac{2\pi}{b}$$
$$\left[0, \frac{2\pi}{b}\right] \longrightarrow 1 \text{ period}$$

**E.g.** Sketch the graph of $y = 3\cos\left(\frac{1}{2}x\right)$ in 1 period.

$a = 3$ ; $b = \frac{1}{2}$ . Amplitude $= \boxed{3}$

$$\text{Period} = \frac{2\pi}{\frac{1}{2}} = \boxed{4\pi}$$

| Max | Intercept | Min | Intercept | Max |
|-----|-----------|-----|-----------|-----|
| Start | $\frac{1}{4}P$ | $\frac{1}{2}P$ | $\frac{3}{4}P$ | End |
| $(0,3)$ | $(\pi, 0)$ | $(2\pi, -3)$ | $(3\pi, 0)$ | $(4\pi, 3)$ |

y

$y = \cos x$

$y = 3\cos\left(\frac{1}{2}x\right)$

O    π    2π    3π    4π

x

E.x.  Given  $y = -\frac{1}{2}\sin\left(\frac{\pi}{2}x\right)$

Find amplitude, period, and 5 key points in 1 period and

use them to sketch the function

Amplitude $= |a| = \left|-\frac{1}{2}\right| = \frac{1}{2}$

Period $= \frac{2\pi}{b} = \frac{2\pi}{\frac{\pi}{2}} = 4$

Intercept   Min   Intercept   Max   Intercept

$(0,0)$   $(1,-\frac{1}{2})$   $(2,0)$   $(3,\frac{1}{2})$   $(4,0)$

Start   $\frac{1}{4}P$   $\frac{1}{2}P$   $\frac{3}{4}P$   end.