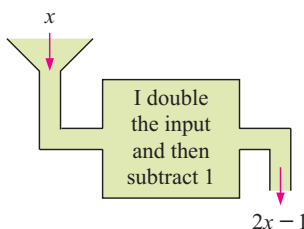


C FUNCTION NOTATION

[3.1, 3.6]

The machine alongside has been programmed to perform a particular function.

If f is used to represent this function, we say that ' f is the function that will convert x into $2x - 1$ '.



If 3 is fed into the machine, $2(3) - 1 = 5$ comes out.

$f(x)$ is read as 'f of x'. It is sometimes called the **image** of x .

So, f would convert 2 into $2(2) - 1 = 3$ and -4 into $2(-4) - 1 = -9$.

This function can be written as: $f: x \mapsto 2x - 1$ or as $f(x) = 2x - 1$.

$\underbrace{\hspace{1.5cm}}_{\text{function } f} \quad \underbrace{\hspace{1.5cm}}_{\text{such that}} \quad \underbrace{\hspace{1.5cm}}_{x} \quad \underbrace{\hspace{1.5cm}}_{\text{maps onto}} \quad \underbrace{\hspace{1.5cm}}_{2x - 1}$

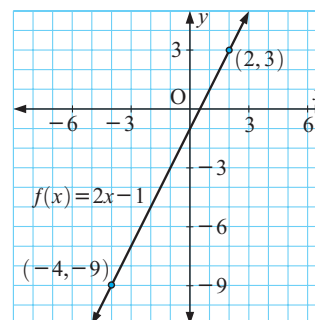


If $f(x)$ is the value of y for a given value of x , then $y = f(x)$.

Notice that for $f(x) = 2x - 1$, $f(2) = 2(2) - 1 = 3$ and $f(-4) = 2(-4) - 1 = -9$.

Consequently, $f(2) = 3$ indicates that the point $(2, 3)$ lies on the graph of the function.

Likewise, $f(-4) = -9$ indicates that the point $(-4, -9)$ also lies on the graph.



Example 4

Self Tutor

If $f: x \mapsto 3x^2 - 4x$, find the value of: **a** $f(2)$ **b** $f(-5)$

$$\begin{aligned} \mathbf{a} \quad f(2) &= 3(2)^2 - 4(2) \quad \{\text{replacing } x \text{ by } (2)\} \\ &= 3 \times 4 - 8 \\ &= 4 \end{aligned}$$

$$\begin{aligned} \mathbf{b} \quad f(-5) &= 3(-5)^2 - 4(-5) \quad \{\text{replacing } x \text{ by } (-5)\} \\ &= 3(25) + 20 \\ &= 95 \end{aligned}$$

Example 5

Self Tutor

If $f(x) = 4 - 3x - x^2$, find in simplest form: **a** $f(-x)$ **b** $f(x + 2)$

$$\begin{aligned} \mathbf{a} \quad f(-x) &= 4 - 3(-x) - (-x)^2 \\ &= 4 + 3x - x^2 \quad \{\text{replacing } x \text{ by } (-x)\} \end{aligned}$$

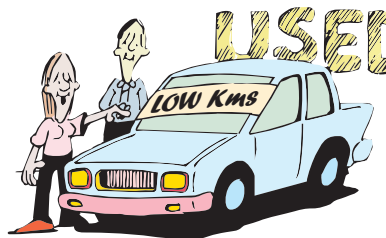
$$\begin{aligned} \mathbf{b} \quad f(x + 2) &= 4 - 3(x + 2) - (x + 2)^2 \\ &= 4 - 3x - 6 - (x^2 + 4x + 4) \\ &= -2 - 3x - x^2 - 4x - 4 \\ &= -x^2 - 7x - 6 \end{aligned}$$

EXERCISE 19C

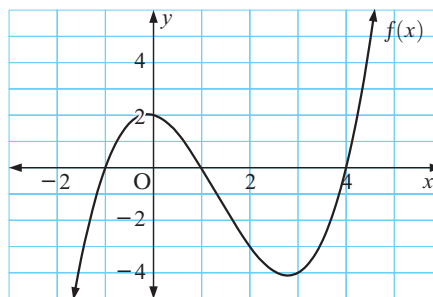
- 1 a** If $f(x) = 3x - 7$, find and interpret $f(5)$.
b If $g : x \mapsto x - x^2$, find and interpret $g(3)$.
c If $H(x) = \frac{2x+5}{x-1}$, find and interpret $H(4)$.
- 2 a** If $f(x) = 5 - 4x$, find: **i** $f(0)$ **ii** $f(3)$ **iii** $f(-4)$ **iv** $f(100)$
b If $E(x) = 2(3 - x)$, find: **i** $E(0)$ **ii** $E(1)$ **iii** $E(5)$ **iv** $E(-2)$
c If $h : x \mapsto \frac{x}{x-3}$, find: **i** $h(2)$ **ii** $h(5)$ **iii** $h(10)$ **iv** $h(-7)$
- 3 a** If $f : x \mapsto 5 - x^2$, find: **i** $f(4)$ **ii** x when $f(x) = 1$.
b If $g(x) = \frac{x+1}{10}$, find: **i** $g(4)$ **ii** a when $g(a) = 2$.
c If $m(x) = x^2 - 3$, find: **i** x when $m(x) = 0$ **ii** x when $m(x) = 1$.
d If $f(x) = 3x + 5$ and $g(x) = 2x - 3$, find x when $f(x) = g(x)$.

- 4** The value of a car t years after purchase is given by $V(t) = 28\,000 - 4000t$ dollars.

- a** Find $V(4)$ and state what this value means.
b Find t when $V(t) = 8000$ and explain what this represents.
c Find the original purchase price of the car.
d Do you think this formula is valid for all $t > 0$?



- 5** Sketch the graph of $y = f(x)$ where $f(x) = 2x - 1$ on the domain $\{x \mid -3 \leq x \leq 1\}$. State the range of this function.
- 6** Sketch the graph of $y = g(x)$ where $g(x) = 6 - 5x$ on the domain $\{x \mid -2 \leq x \leq 2\}$. State the range of this function.
- 7** The graph of a function is given alongside. Use the graph to:



- 8** If $f(x) = 5 - 2x$, find in simplest form:
a $f(a)$ **b** $f(-a)$ **c** $f(a+1)$ **d** $f(x-3)$ **e** $f(2x)$
- 9** If $P(x) = x^2 + 4x - 3$, find in simplest form:
a $P(x+2)$ **b** $P(1-x)$ **c** $P(-x)$ **d** $P(x^2)$ **e** $P(x^2 + 1)$