Dr Oliver Mathematics
Worked Examples
A Function 1

From: AQA Further Mathematics Level 2 (Non-Calculator)

1. (6)

$$\mathrm{f}(x) = \frac{x-3}{2x}.$$

Solve

$$\mathrm{f}(x+1) - \mathrm{f}(2x) = 0.5.$$

You **must** show your working.

Solution

Now,

$$\begin{aligned}\mathrm{f}(x+1) &= \frac{(x+1)-3}{2(x+1)} \\ &= \frac{x-2}{2(x+1)}\end{aligned}$$

and

$$\begin{aligned}\mathrm{f}(2x) &= \frac{(2x)-3}{2(2x)} \\ &= \frac{2x-3}{4x}.\end{aligned}$$

Next,

$$\mathrm{f}(x+1) - \mathrm{f}(2x) = 0.5 \Rightarrow \frac{x-2}{2(x+1)} - \frac{2x-3}{4x} = \tfrac{1}{2}$$

$\mathrm{LCM}[2(x+1), 4x] = 4x(x+1)$

$$\Rightarrow \frac{2x(x-2) - (2x-3)(x+1)}{4x(x+1)} = \tfrac{1}{2}$$

$\times$	$2x$	-3
x	$2x^2$	$-3x$
$+1$	$+2x$	-3

$$\Rightarrow \frac{(2x^2-4x)-(2x^2-x-3)}{4x(x+1)} = \tfrac{1}{2}$$
$$\Rightarrow \frac{2x^2-4x-2x^2+x+3}{4x(x+1)} = \tfrac{1}{2}$$
$$\Rightarrow \frac{-3x+3}{4x(x+1)} = \tfrac{1}{2}$$
$$\Rightarrow 2(-3x+3) = 4x(x+1)$$
$$\Rightarrow -6x+6 = 4x^2+4x$$
$$\Rightarrow 4x^2+10x-6 = 0$$
$$\Rightarrow 2(2x^2+5x-3) = 0$$

add to: $+5$
multiply to: $(+2)\times(-3) = -6$ $\Big\}$ $-1,\ +6$

$$\Rightarrow 2[2x^2+6x-x-3] = 0$$
$$\Rightarrow 2[2x(x+3)-1(x+3)] = 0$$
$$\Rightarrow 2(2x-1)(x+3) = 0$$
$$\Rightarrow \underline{\underline{x = \tfrac{1}{2} \text{ or } x = -3.}}$$