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§1.2 Function Notation

Function notation is simply the representation of what was formally known as y , as $f(x)$. $f(x)$ is said "f of x" or sometimes "f at x". This is to denote the dependent variable by showing its dependence on x , the independent variable.

It is also acceptable to use $g(x)$, $p(x)$, etc. In physics, we often use $h(t)$ to represent height as a function of time, t .

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Recall that in grade 9 academic mathematics, you studied linear systems. You used the function $y=mx+b$. Now you would represent that function as $f(x)=mx+b$.

Example: Given $f(x) = 3x-4$ find:

- $f(5)$
- $f(-1)$
- x when $f(x) = 17$

Solution: Find a) $f(5)$

$$\begin{aligned} f(x) &= 3x-4 \\ f(5) &= 3(5)-4 \\ f(5) &= 15-4 \\ f(5) &= 11 \end{aligned}$$

Solution: Find b) $f(-1)$

$$\begin{aligned} f(x) &= 3x-4 \\ f(-1) &= 3(-1)-4 \\ f(-1) &= -3-4 \\ f(-1) &= -7 \end{aligned}$$

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Solution: c) Find x when $f(x) = 17$

$$\begin{aligned} f(x) &= 3x-4 \\ 17 &= 3x-4 \\ 17+4 &= 3x-4+4 \\ 21 &= 3x \end{aligned}$$

$$\begin{aligned} \frac{3x}{3} &= \frac{21}{3} \\ x &= 7 \end{aligned}$$

Given the function $f(x) = x^2 - 4x$ and $g(x) = -8x + 5$.

- Show that $f(5) > g(5)$ and explain what this means vis-à-vis their graphs.
- Determine $g(9a)$.
- Determine $f(p-1) - g(p-1)$

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Solution: a) Show that $f(5) > g(5)$ and explain what this means vis-à-vis their graphs.

$$\begin{aligned} f(x) &= x^2 - 4x & g(x) &= -8x + 5 \\ f(5) &= (5)^2 - 4(5) & g(5) &= -8(5) + 5 \\ f(5) &= 25 - 20 & g(5) &= -40 + 5 \\ f(5) &= 5 & g(5) &= -35 \end{aligned}$$

Hence $f(5) > g(5)$. This means that at the point $x=5$, the point from $f(x)$ is above the point from $g(x)$.

Solution: b) Determine $g(9a)$.

$$\begin{aligned} g(x) &= -8x + 5 \\ g(9a) &= -8(9a) + 5 \\ g(9a) &= -72a + 5 \end{aligned}$$

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Solution: c) Determine $f(p-1) - g(p-1)$

$$\begin{aligned} f(x) - g(x) &= (x^2 - 4x) - (-8x + 5) \\ f(x) - g(x) &= x^2 - 4x + 8x - 5 \\ f(x) - g(x) &= x^2 + 4x - 5 \\ f(p-1) - g(p-1) &= (p-1)^2 + 4(p-1) - 5 \\ f(p-1) - g(p-1) &= p^2 - 2p + 1 + 4p - 4 - 5 \\ f(p-1) - g(p-1) &= p^2 + 2p - 8 \end{aligned}$$

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Given $f(x) = 2x-1$ and $g(x) = 4x-7$

Find:

- $f(5)$
- $2f(5)$
- $g(2)$
- $3g(2)$
- $2f(5) - 3g(2)$

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Given $f(x) = 2x-1$ and $g(x) = 4x-7$

$$\begin{aligned} \text{a) } f(5) &= 2(5) - 1 \\ &= 10 - 1 \\ &= 9 \\ \text{b) } 2f(5) &= 2(9) \quad \text{THINK: twice the result } f(5) \\ &= 18 \\ \text{c) } g(2) &= 4(2) - 7 \\ &= 8 - 7 \\ &= 1 \\ \text{d) } 3g(2) &= 3(1) \quad \text{THINK: thrice the result } g(2) \\ &= 3 \\ \text{e) } 2f(5) - 3g(2) &= 2(9) - 3(1) \\ &= 18 - 3 \\ &= 15 \end{aligned}$$

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Christian wants a good grade in MCR3U. He decides to put math to work. He notices that for every hour invested doing math homework and watching KhanAcademy videos, his test marks go up by 7%. In the first unit, he did not study at all and he got a 51%.

- Design a function that represents this situation.
- What would be an appropriate domain for this situation?
- What would be an appropriate range for this situation?
- What would $M(4.5)$ mean?
- What conditions would have to occur for Christian to obtain a 75% in this class?

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- Design a function that represents this situation. Let t represent the amount of time Christian studies in hours. Let $M(t)$ be the mark Christian gets as a percent in MCR3U as a function of time.

$$M(t) = 7t + 51$$

- What would be an appropriate domain for this situation? The domain should be from selected from Real numbers such that Range = $\{t \geq 0\}$. THINK: you can study 4.25 hours.

- What would be an appropriate range for this situation?

The range should be from selected from Real numbers such that Range = $\{51 \leq t \leq 100\}$. THINK: you can get 75.6%

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d) What would $M(4.5)$ mean?

It would represent the mark that Christian would get if he studied for 4.5 hours. In this case:

$$\begin{aligned}M(t) &= 7t + 51 \\M(4.5) &= 7(4.5) + 51 \\&= 31.5 + 51 \\&= 82.5\%\end{aligned}$$

Christian would get an 82.5% percent (note the units in the final answer).

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e) What conditions would have to occur for Christian to obtain a 75% in this class?

In this case,

$$\begin{aligned}M(t) &= 7t + 51 \text{ AND} \\M(t) &= 75 \quad \text{Hence}\end{aligned}$$

$$\begin{aligned}7t + 51 &= 75 \\7t + 51 - 51 &= 75 - 51 \\7t &= 24 \\t &\approx 3.4 \text{ hours}\end{aligned}$$

Christian would have to study 3.4 hours to ensure he gets a 75%.

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HOMEWORK: §1.2 #1,2,5-8,11,17

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