MATH110-S01-S02 200930 Quiz 0 Solutions

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1. We can work this out in stages. We have

$$
\begin{aligned}
f(a) &= 2a^2-3 \\
f(a+h) &= 2(a+h)^2-3 = 2(a^2+2ah+h^2)-3 = 2a^2+4ah+2h^2-3 \\
f(a+h)-f(a) &= 2a^2+4ah+2h^2-3-(2a^2-3) = 2a^2+4ah+2h^2-3-2a^2+3 = 4ah+2h^2
\end{aligned}
$$

so

$$\frac{f(a+h)-f(a)}{a+h-a} = \frac{4ah+2h^2}{h}$$

You can cancel a common factor of h from *every* term in the above expression to obtain a final answer of $4a+2h$, but that cancellation isn't really one hundred percent correct unless you know that $h \neq 0$.

2. (a) We write $g(F)$ in standard form by expanding the bracket:

$$g(F) = \frac{5}{9}F - \frac{160}{9}$$

The slope is the coefficient of F, which is $5/9$. It represents the change in the Celsius temperature for each one degree change in the Fahrenheit temperature.

(b) Based on the above standard form, the C intercept is $-160/9 \approx -17.78$. That represents the temperature in Celsius corresponding to the temperature of 0 degrees Fahrenheit.

(c) We have

$$h \circ g(F) = h(g(F)) = \frac{9}{5}(g(F))+32 = \frac{9}{5}\left(\frac{5}{9}(F-32)\right)+32 = F-32+32 = F$$

We can say that $h \circ g$ is the identity function. That makes sense because g takes a temperature in Fahrenheit and converts it to Celsius, while h converts the Celsius temperature back to Fahrenheit, so the composition should bring us back where we started.