Differentiation Structured Worksheet 3

1. Show that

$$\frac{d}{dx}\left((1+\cos x)^3 \sin x\right) = (1+\cos x)^3(4\cos x - 3).$$

(Hint: you may need to use a famous formula involving trigonometric functions.)

Solution By the [ ] and [ ] Rules,

$$\begin{aligned}
\frac{d}{dx}\left((1+\cos x)^3 \sin x\right) &= \\
&= \\
&= \\
&= \\
&= \\
&=
\end{aligned}$$

2. Show that if $f(x) = \tan x$, the Newton Quotient $N(h)$ for f at the point x is given by

$$N(h) = \frac{\tan h}{h}\left(\frac{1+\tan^2 x}{1-\tan x \tan h}\right),$$

and hence deduce that

$$\frac{d}{dx}(\tan x) = 1 + \tan^2 x.$$

Solution The Newton Quotient $N(h)$ is given by

$$\begin{aligned} N(h) &= \frac{1}{h}\Big(\qquad\qquad\qquad\Big) \\ &= \\ &= \\ &= \qquad\qquad\qquad\qquad . \end{aligned}$$

Since $\lim_{h\to 0} \tan h =$ $\square$ and $\lim_{h\to 0} \dfrac{\tan h}{h} =$ $\square$, we have

$$\lim_{h\to 0} N(h) = \square \cdot \frac{\square}{1-\square} = \square .$$