

**MTH4100**

**Calculus 1, Autumn 2012**

**Exercise sheet 3**

**Prof. Bill Jackson**

---

These questions are designed to help you understand the material covered in week  $n$ ,  $n \in \mathbb{N}$  lectures. Exercise sheets will typically be handed out in the Tuesday lecture of week  $n + 1$ . You will get help on them in your exercise class on Tuesday or Wednesday of the same week. You should write up your solution to the starred question (\*) clearly and hand it in to your tutor during your week  $n + 2$  exercise class for feedback. Put your *full name and student number* on the top of your solution. It is important that you try to do ALL of the questions, not just the starred question.

---

You can use the fact that  $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$  in questions 2(c) and 3(a) below.

1. Determine whether the following limits exist and evaluate them when they do exist.

(a)

$$\lim_{x \rightarrow x_0} \frac{x}{x - 5},$$

for (i)  $x_0 = 1$ , and (ii)  $x_0 = 5$ ,

(b)

$$\lim_{x \rightarrow 4} \frac{x^2 - 8x + 16}{x^2 - 5x + 4},$$

(c)

$$\lim_{x \rightarrow x_0} \frac{x - 5}{x^2 - 10x + 25},$$

for (i)  $x_0 = 5$ , and (ii)  $x_0 = 4$ .

2. Compute the following limits:

[2007 and 2008 exam questions]

$$(a) \quad \lim_{x \rightarrow -3^-} (x + 4) \frac{|x + 3|}{x + 3}, \quad (b) \quad \lim_{u \rightarrow 3} \frac{u^3 - 27}{u^4 - 81}, \quad (c) \quad \lim_{x \rightarrow 0} \frac{6x + 6x \cos(6x)}{\sin(6x) \cos(6x)}.$$

(\*)3. Compute the following limits:

[2008 and 2009 exam questions]

$$(a) \quad \lim_{t \rightarrow 0} \frac{\sin(4 - 4 \cos(2t))}{1 - \cos(2t)}, \quad (b) \quad \lim_{t \rightarrow 5} \frac{t^2 + 3t - 40}{t^2 - 25}, \quad (c) \quad \lim_{x \rightarrow 2} \frac{\sqrt{x^2 + 5} - 3}{x - 2}.$$