

**1M01 Mathematical Methods 2010–11**  
**Calculus tutorial exercise sheet 6**

1. Convert the following angles.

Notes: 50

- (a)  $360^\circ$  into radians      (b)  $35^\circ$  into radians  
(c)  $-1.5\pi$  into degrees      (d) 2.2 radians into degrees

2. The day length in Dublin depends on the time of year. The longest day lasts 17 hours, the shortest day lasts 7 hours and the average day length is 12 hours.

Notes: 52,53

Let  $L(t)$  denote the day length in Dublin, where  $t$  is the time in years since the longest day of the year 2000.

- (a)  $L(t)$  is periodic, with period one year. Explain why (briefly).  
(b) Find a suitable formula for  $L(t)$  and sketch the graph of this function for  $0 \leq t \leq 2$ .  
(c) Estimate the day length two months (that is,  $\frac{2}{12}$  of a year) after the longest day of the year 2000.

3. (a) Find  $\frac{d}{dt}(-4 \cos(3t^2))$ .

Notes: 54,55

(b) If  $y = x^2 + \sin(2x + \pi)$ , find  $\frac{dy}{dx}\Big|_{x=\pi}$ .

(c) Differentiate  $\cos(x^{-1} - \sin(x))$ .

4. (a) What is  $\int \frac{5 \sin(x)}{3} dx$ ?

Notes: 55

(b) What is the average value of  $y = \cos(x)$  as  $x$  varies from 0 to  $\pi/2$ ?

(c) Find  $\int_0^{\pi/4} 3 - 2 \sin(2t) dt$ .