

**CALCULUS OPTION (Q 8, PAPER 2)**

**2005**

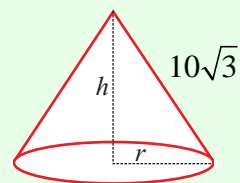
8 (a) Use integration by parts to find  $\int x^2 \ln x dx$ .

8 (b) (i) Derive the Maclaurin series for  $f(x) = \ln(1+x)$  up to and including the term containing  $x^3$ .

(ii) Use those terms to find an approximation for  $\ln \frac{11}{10}$ .

(iii) Write down the general term of the series  $f(x)$  and hence show that the series converges for  $-1 < x < 1$ .

8 (c) A cone has radius  $r$  cm, vertical height  $h$  cm and slant height  $10\sqrt{3}$  cm. Find the value of  $h$  for which the volume is a maximum.



**ANSWERS**

8 (a)  $\frac{1}{3}x^3 \ln x - \frac{1}{9}x^3 + c$

8 (b) (i)  $x - \frac{1}{2}x^2 + \frac{1}{3}x^3$       (ii)  $\frac{143}{1500}$       (iii)  $u_n = (-1)^{n-1} \frac{x^n}{n}$

8 (c)  $h = 10$  cm