

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

**2000**

8 (a) Use the ratio test to show that  $\sum_{n=1}^{\infty} \frac{(n+2)!}{2^{n+2}}$  is divergent.

8 (b) (i) Use integration by parts to find  $\int e^{2x} \cos x dx$ .

(ii) Given that  $\int_0^{\frac{\pi}{2}} e^{2x} \cos x dx = \frac{1}{n}(e^{\pi} - 2)$ , find the value of  $n$  where  $n \in \mathbf{N}$ .

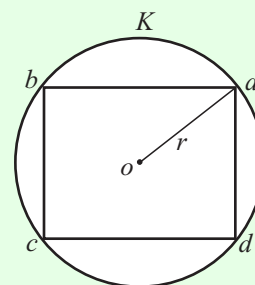
8 (c)  $K$  is a circle with centre  $o$ .

$a, b, c$  and  $d$  are points on  $K$  such that  $abcd$  is a rectangle.

$|oa| = r$  cm;  $|ab| = 2x$  cm and  $|ad| = 2y$  cm.

(i) Express  $y$  in terms of  $x$  and  $r$ .

(ii) Hence, or otherwise, show that the maximum area of  $abcd$  is  $2r^2$  cm<sup>2</sup>.



**ANSWERS**

8 (a)

8 (b) (i)  $\frac{2}{5} e^{2x} \cos x + \frac{1}{5} e^{2x} \sin x + c$  (ii)  $n = 5$

8 (c) (i)  $y = \sqrt{r^2 - x^2}$