6. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

(i) Solve, using logarithms,

$$7^{x+3} = 5$$

giving the answer to 3 significant figures.

(2)

(ii) (a) Show that the equation

$$18(\log_8 y)^2 + 5\log_8(64y^3) = 73$$

can be written as

$$6(\log_8 y)^2 + 5\log_8 y - 21 = 0$$

(3)

(b) Hence find the exact values of y for which

$$18(\log_8 y)^2 + 5\log_8(64y^3) = 73$$

(3)

(Total for Question 6 is 8 marks)

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7. The circle C has equation

$$(x-3)^2 + (y-6)^2 = k$$

where k is a positive constant.

(a) Write down the coordinates of the centre of C.

(1)

The line l passes through the origin, O, and the centre of C.

(b) Find an equation for the line l, giving the answer in the form $y = mx$, where m is a constant.

(2)

Given that

- the point A is the point on C closest to O
- the distance OA is $\sqrt{5}$

(c) find the two possible values of k.

(4)

(Total for Question 7 is 7 marks)



8. (a) Find the first four terms, in ascending powers of x, of the binomial expansion of $(k + 4x)^{12}$, where k is a constant. Give each term in simplest form.

(4)

Given that the coefficient of x^3 in this expansion is $\frac{55}{2}$

(b) find the value of k.

(2)

Using the value of k found in part (b) and the answer to part (a),

(c) find the coefficient of y^3 in the expansion of

$$\left(y + \frac{2}{y}\right)\left(k + 4y^2\right)^{12}$$

(3)

(Total for Question 8 is 9 marks)