# Just what the Doctor ordered

*Any solution based entirely on graphical*
*or numerical methods is not acceptable*

Marks Available : 40

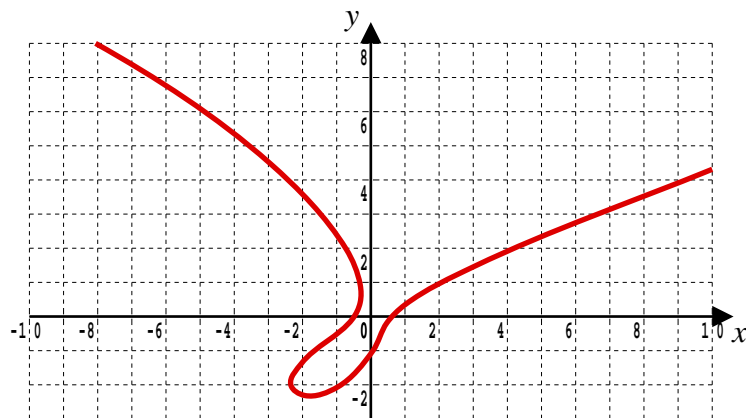**Question 1**

Solve the equation,

$$2^{2x+1} - 17 \times 2^x + 2^3 = 0$$

[ **4 marks** ]

**Question 2**

The curve shown has equation $3x^2 - y^3 - 5xy = 1$



Find the numerical value of the gradient of the curve at the point $(2,\ 1)$

**[ 5 marks ]**

## Question 3

The number of daylight hours, $h$, in England, $d$ days after the spring equinox (the day in spring when the number of daylight hours is 12) is modelled by,

$$h = 12 + \frac{9}{2} \sin\left(\frac{2\pi}{365} d\right)$$

**( i )**   Find the number of daylight hours 25 days after the spring equinox. Give your answer in hours and minutes.

**[ 2 marks ]**

**( ii )**   What is the maximum possible number of daylight hours, according to the model ?  Give your answer in hours and minutes.
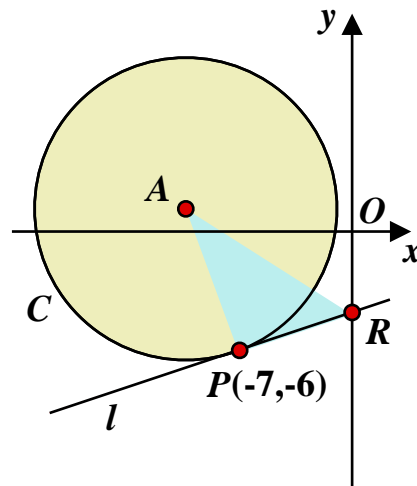
**[ 1 mark ]**

**( iii )**   How many days after the spring equinox, does this maximum number of daylight hours occur ?

**[ 1 mark ]**

**( iv )**   For how many days of the year does the model suggest the number of daylight hours exceeds 15 hours.
Give your answer as a whole number of days.

**[ 4 marks ]**

**Question 4**



The circle $C$ has equation $x^2 + 18x + y^2 - 2y + 29 = 0$

**( i )**     Verify the point $P(-7, -6)$ lies on $C$.

**[ 2 marks ]**

**( ii )**     Find an equation for the tangent to $C$ at the point $P$, giving your answer
in the form $y = mx + c$

**[ 4 marks ]**

**( iii )**     Find the area of the triangle $APR$

**[ 4 marks ]**

**Question 5**

The second term of a geometric sequence is 4, and the sixteenth term of the same sequence is 9. The common ratio is $r$, where $r > 0$.
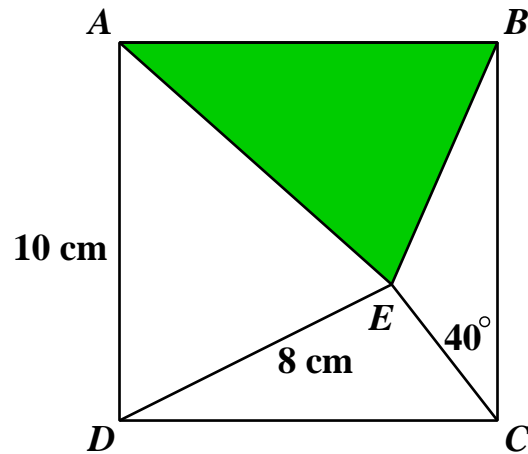
**( i )**    Show that $r$ satisfies the equation, $14 \ln r + \ln\left(\dfrac{4}{9}\right) = 0$

**[ 3 marks ]**

**( ii )**    Hence, or otherwise, find the value of $r$ correct to 3 significant figures.

**[ 3 marks ]**

**Question 6**



*ABCD* is a square.
Angle *CED* is obtuse.
Find the area of the shaded triangle.

**[ 7 marks ]**