Y12**: EXCELLENCE LEVEL B**  .

**ALGEBRA.**

1. Find the value of the constant “c” so that the line ***y = 3x + c*** is a tangent to the

curve ***y = – 12 If 3x + c = -12/x***

***x 3x2 + cx = - 12***

***3x2 + cx + 12 = 0***

***If tangent then discrim = 0***

***c2 – 4.3.12 = 0***

***c2 = 144***

***c = ± 12***

2. A Biological researcher found that the number of bacteria in a culture could be calculated at some future time using a formula of the form ***N = A×bt***

Where ***N*** = the number of bacteria at ***t*** hours. ***A*** and ***b*** are unknown constants.

She estimated that at ***t = 4 hours, N was 5,600 and at t = 7 hours, N was 59,700.***

Use this information to calculate the constants ***A*** and ***b*** then use your formula to estimate the number of bacteria at ***t = 12*** hours.

***Subs 5600 = A.b4 and 59700 = A.b7***

***59700 = A.b7 so b3 = 59700 so b = 2.2 sub 5600 = A 2.24***

***5600 A.b4 5600 A = 239***

***N = 239×2.212 = 3072345***

**CALCULUS**

2. A 40 cm piece of wire is cut into two pieces.

The first piece is shaped into a circle of area A , and the second piece into a square of area B.

Find the minimum value of the total area A + B.

***Lengths are x and 40 – x if circumf = x then 2πr = x so r = x/(2π)***

***Area A + B = πr2 + (40 – x)2***

***16***

***AREA = π x2 + 1600 – 80x + x2 = x2 + 100 – 5x + x2 40 – x***

***4π2 16 4π 16 4***

***d(Area) = x – 5 + x = 0 for max Area***

***dx 2π 8 40 – x***

***4***

***x( 1 + 1) = 5***

***2π 8***

***x ×0.28415 = 5***

***x = 17.6 cm so r = 2.8***

***So Min Area = π×2.82 + 5.62 = 56 cm2***