**Day 53** **IGCSE 10-a-day**

**1** The number of bacteria in a culture, N, after t hours is modelled by

$N = -t^3 + 15t^2 + 9t + 1000$ for $0 \leq t \leq 20$

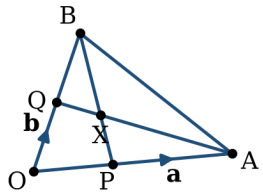
Find the time at which N is increasing most rapidly, and the rate of increase at this time.

**2** $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$, $\mathbf{OP} = \frac{2}{5}\mathbf{a}$ and $\mathbf{OQ} = \frac{1}{2}\mathbf{b}$.

AQ and BP meet at X.

(a) Find $\mathbf{OX}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

(b) Find the ratio AX : XQ.

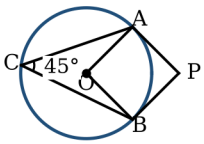



**3** PA and PB are tangents to a circle, centre O. C is a point on the circle. Angle ACB = 45°.

(a) Work out the size of angle AOB.

(b) Work out the size of angle APB.

The diagram is not drawn accurately.




**4** A square has sides of length $(7 + \sqrt{3})$ cm.

Work out the area of the square.

Give your answer in the form $a + b\sqrt{3}$

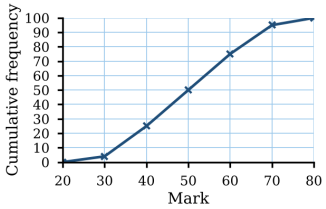
**5** A curve has equation $y = -3x^2 - \frac{6}{x}$.

Find the equation of the tangent to the curve at the point where $x = -1$.

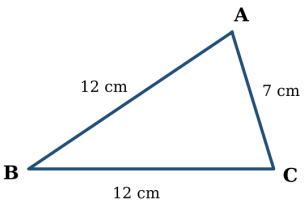
| Day 53 | IGCSE 10-a-day |
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**6** Solve $5^{2x-4} = \frac{1}{25}$

**7** The cumulative frequency graph gives information about the marks of 100 students in a test.
(a) Find an estimate for the median and the interquartile range.
(b) Estimate how many of the 100 had a mark greater than 65.




**8** Work out the area of triangle ABC.
Give your answer correct to 3 significant figures. (Calculator)




**9** A storage unit is a cuboid with a square base of side x metres and height h metres, and has a closed top. Its volume is 512 $m^3$.
(a) Show that the total outside surface area, A $m^2$, is $A = 2x^2 + \frac{2048}{x}$.
(b) Find the minimum possible value of A, showing that it is a minimum.

**10** A circle has equation $x^2 + y^2 = 841$.
The point P(20, −21) lies on the circle.
(a) Find the equation of the tangent to the circle at P. Give your answer in the form ax + by = c, where a, b and c are integers.
(b) The tangent meets the x-axis at the point T. Write down the coordinates of T.