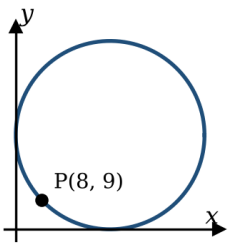
Day 166 **A Level Maths: S Tier 10-a-day**

1 The circle in the diagram touches both axes and passes through P. Find the equation of the circle, giving it in the form $x^2 + y^2 + ax + by + c = 0$.



2 Solve $\cos(3\theta - 45°) = \frac{\sqrt{3}}{2}$ for $0° \leq \theta \leq 360°$.

3 A binomial random variable X has mean 13 and variance $\frac{26}{3}$.
(a) Find n and p.
(b) Find P(X = 12), correct to 3 significant figures.

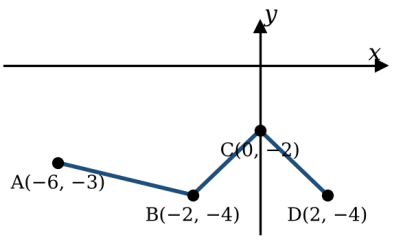
4 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours.
Initially P = 400 and after 5 hours P = 1200.
Find k, and the time for the population to reach 1200, to 3 s.f.

5 A particle P moves in a plane. At time t seconds its position vector relative to a fixed origin O is r metres, where
$\mathbf{r} = (-2t^2 - t)\mathbf{i} + (1.5t^2 + 5t)\mathbf{j}$.
Find (a) the value of t at which P is moving parallel to $(\mathbf{i} - \mathbf{j})$, (b) the speed of P at this time (3 s.f. if not exact).

Day 166 **A Level Maths: S Tier 10-a-day**

6 A faulty component is present in 0.5% of a population. A test is positive for 98% of those with it and for 8% of those without it.
Find P(positive) and P(has it | positive).

7 The diagram shows y = f(x), made of three straight line segments. Find the coordinates of the images of A, B, C and D on the graph of $y = -2f(\frac{1}{2}x + 1) - 2$.



8 Find the coefficient of x^4 in the expansion of $(x - 3)(1 + 4x)^6$.

9 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(4\mathbf{i} + 4\mathbf{j})$ km relative to a fixed origin and B is at $(3\mathbf{i} - 3\mathbf{j})$ km. A has velocity $(2\mathbf{i} + 3\mathbf{j})$ km h^{-1} and B has velocity $(-\mathbf{i} + 7\mathbf{j})$ km h^{-1}.
Find (a) the time at which the ships are closest together, (b) the least distance between them.

10 A curve has parametric equations $x = 3t^2$, $y = 3t(6 - t)$,
for $0 \leq t \leq 6$. The curve meets the x-axis at O and at A.
Find the area enclosed between the curve and the x-axis.