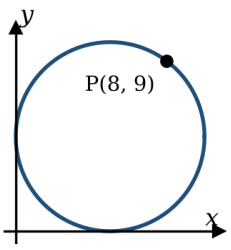
Day 120	A Level Maths: S Tier 10-a-day
1 A stone is projected from a point O on horizontal ground with speed 49 m s^{-1} at an angle α above the horizontal, where $\tan\alpha = \frac{4}{3}$. Find (a) the time of flight, (b) the range, (c) the greatest height. Take g = 9.8 m s^{-2}.	
2 The heights of plants, in cm are normally distributed. 5% are less than 42 and 30% are greater than 66. Find the mean and standard deviation, each correct to 3 significant figures.	
3 Use the trapezium rule with 6 strips to estimate $\int_1^2 \frac{1}{\sqrt{1+x}}\,dx$, to 4 s.f. Is it an overestimate or an underestimate? Explain.	
4 A binomial random variable X has mean 16 and variance 9.6. (a) Find n and p. (b) Find P(X = 16), correct to 3 significant figures.	
5 Find the set of values of x for which both $x^2 + 2x - 3 > 0$ and $-x + 3 \leq 6$.	

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6 The curve $y = 3x^2\sqrt{20 - x}$, for $0 < x < 20$, has one stationary point. Find its exact coordinates and determine its nature.

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



8 Prove by contradiction that $\log_5 12$ is irrational.

9 Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(5\mathbf{j})$ km relative to a fixed origin and B is at $(-15\mathbf{i})$ km. A has velocity $(-3\mathbf{i} + 2\mathbf{j})$ km h^{-1} and B has velocity $(\mathbf{i} + 5\mathbf{j})$ km h^{-1}.
Find (a) the time at which the ships are closest together, (b) the least distance between them.

10 (a) Show that $\frac{x^2 + 12x + 22}{(x + 3)(x + 2)} \equiv 1 + \frac{A}{x + 3} + \frac{B}{x + 2}$.

(b) Hence find the exact value of $\int_0^1 \frac{x^2 + 12x + 22}{(x + 3)(x + 2)}\,dx$.