Day 257	A Level Maths: S Tier 10-a-day

1 A particle P moves on a straight line. At time t seconds, where $t \geq 0$, its velocity is v m s^{-1}, where

$v = 16\sqrt{t} - 4t$.

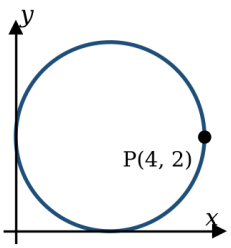
Find (a) the greatest speed of P, (b) the greatest displacement of P from its starting point.

2 Use the trapezium rule with 5 strips to estimate

$\int_1^2 x\, e^{-x}\, dx$, to 4 s.f.

Is it an overestimate or an underestimate? Explain.

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



4 Solve $e^x + 6\, e^{-x} = 5$,
giving your answers exactly in terms of natural logarithms.

5 Car A passes a point O travelling at a constant speed of 13.5 m s^{-1}. 10 s later, car B leaves O from rest with constant acceleration 3 m s^{-2}, travelling in the same direction.
B overtakes A at the point X. Find (a) the time B takes to reach X, (b) the distance OX, (c) the speed of B at X.

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6 A data set has lower quartile 25 and upper quartile 31. An outlier is a value more than 1.5 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 8 observations have mean 28. The largest is 47, an outlier, and it is removed. Find the new mean.	
7 (a) Expand $(16 - x)^{-\frac{1}{2}}$ up to and including the term in x^2. (b) Use $x = 0.02$ to estimate $\frac{1}{\sqrt{15.98}}$ to 5 decimal places.	
8 The points A, B, C have coordinates (5, 4, 3), (−1, 4, −2), (−2, 3, −1). Find angle ABC to 1 d.p., and the exact area of triangle ABC.	
9 $f(x) = \frac{11x + 5}{(1 - x)(1 + 3x)}$. (a) Express f(x) in partial fractions. (b) Hence expand f(x) in ascending powers of x up to x^3, stating the range of validity.	
10 The lengths of a component, in mm are modelled by $N(99, \sigma^2)$. The probability of a value below 90 is 0.20. (a) Find σ. (b) Find the probability of a value below 124.	