| Day 167 | A Level Maths: S Tier 10-a-day |
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| **1** Solve simultaneously, giving integer x and y:<br>$2^x \times 4^y = 512$<br>$9^x \div 3^y = 27$ | |
| **2** Find the exact value of<br>$\int_0^{\pi/3} \tan x \, dx$ | |
| **3** Three forces $(3\mathbf{j})$ N, $(-4\mathbf{i} + k\mathbf{j})$ N and $(-6\mathbf{i} - 4\mathbf{j})$ N act on a particle of mass 5 kg. The resultant is parallel to $(-5\mathbf{i} - \mathbf{j})$.<br>Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f. | |
| **4** 10 recorded masses (grams) have mean 47 and standard deviation 8.<br>One value was recorded as 32 but should have been 18.<br>Find the correct mean and the correct standard deviation. | |
| **5** Solve $2^{2x+2} - 33 \times 2^x + 8 = 0$. | |

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| **6** A ball is projected from a point O on horizontal ground at 45° to the horizontal. The ball just passes over the top of a vertical wall of height 7.2 m, at a horizontal distance of 72 m from O. Find (a) the speed of projection, (b) the greatest height of the ball above the ground, to 3 s.f. Take g = 9.8 m $s^{-2}$. | |
| **7** Use the substitution $u = x^2 + 2$ to find the exact value of $\int_0^1 x(x^2 + 2)^3 \, dx$ | |
| **8** The curve C has equation $x^2y + xy^2 = 84$. Find the equation of the tangent to C at the point (3, 4), in the form $ax + by + c = 0$ with integers a, b, c. | |
| **9** Find the binomial expansion of $(27 - x)^{\frac{2}{3}}$ in ascending powers of x up to and including the term in $x^3$. State the values of x for which it is valid. | |
| **10** $X \sim B(9, \frac{1}{4})$. (a) Show that $P(X = r + 1) \div P(X = r) = \frac{9 - r}{r + 1} \times \frac{1}{3}$. (b) Find the most likely value of X and its probability (3 s.f.). | |