| Day 26 | A Level Maths: S Tier 10-a-day |
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| **1** Solve $\log_2(x + 2) + \log_2(x - 2) = 5$, justifying clearly any root that you reject. | |
| **2** Prove that $n^2(n^2 - 1)$ is divisible by 12 for every positive integer n. | |
| **3** A stone is thrown vertically upwards with speed 20 m $s^{-1}$ from the top of a cliff. The top of the cliff is 56.4 m above the sea. Find (a) the time taken for the stone to reach the sea, (b) the total distance travelled by the stone, to 3 s.f. Take g = 9.8 m $s^{-2}$. | |
| **4** (a) Expand $(27 + x)^{\frac{1}{3}}$ up to and including the term in $x^2$. (b) Use x = 0.03 to estimate $\sqrt[3]{27.03}$ to 5 decimal places. | |
| **5** A drink cools according to $\theta = 22 + Ae^{-kt}$, where $\theta$ °C is the temperature after t minutes. Initially $\theta = 100$, and after 6 minutes $\theta = 74$. Find A and k, then find when $\theta = 66$ (3 s.f.). | |

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| **6** Solve simultaneously, giving integer x and y:<br>$4^x \times 16^y = 4096$<br>$3^x \div 9^y = 9$ | |
| **7** The lengths of a component, in mm are modelled by N(93, $\sigma^2$). The probability of a value above 108 is 0.15.<br>(a) Find $\sigma$.<br>(b) Find the probability of a value below 84. | |
| **8** The points A, B, C have coordinates $(-3, 3, 0)$, $(-2, -3, -3)$, $(1, 3, 2)$.<br>Find angle ABC to 1 d.p., and the exact area of triangle ABC. | |
| **9** Class S has 12 students with mean mark 78 and standard deviation 8. Class P has 15 students with mean mark 33 and standard deviation 5.<br>(a) Find the mean mark of all 27 students.<br>(b) Find the standard deviation of all 27 students. | |
| **10** A particle P moves on a line. Its displacement from a fixed point O at time t seconds is s metres, where $s = 6 \sin 2t + 8 \cos 2t$.<br>Find (a) the greatest distance of P from O, (b) the greatest speed of P, (c) the first time P is at its greatest distance from O (3 s.f.). | |