| Day 180 | A Level Maths: A Tier 10-a-day |
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| **1** $f(x) = x^3 - 8x^2 + 20x - 15$.<br>(a) Show that $(x - 3)$ is a factor of $f(x)$.<br>(b) Solve $f(x) = 0$, giving surds in simplest form. | |
| **2** A stratified sample of 80 students is taken from three groups.<br>9 of the sample are from Arts, which has 54 students.<br>(a) Find the total number of students.<br>(b) Science has 78 students. How many are sampled? | |
| **3** Solve $x^4 - 26x^2 + 25 = 0$. | |
| **4** A 8 kg particle moves on a smooth horizontal line. At time t s a single force of $(16 - 4t)$ N acts along the line. When $t = 0$ its speed is 0 m $s^{-1}$. Find (a) its speed when $t = 5$, (b) its greatest speed. | |
| **5** $f(x) = e^x + 1x - 8$.<br>Use the Newton-Raphson method with $x_0 = 2$ to find $x_1$ and $x_2$, giving your answers to 4 d.p. | |

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| **6** A particle moves in a straight line with velocity v = $(-6t^2 + 24t)$ m $s^{-1}$ at time t s, $t \geq 0$, starting at O. Find (a) its greatest speed, (b) its distance from O when t = 4, (c) the time at which it returns to O. | |
| **7** X has pdf $f(x) = \frac{6}{27}x(3 - x)$ for $0 \leq x \leq 3$, and 0 otherwise.<br>Find E(X), Var(X) and the standard deviation of X (3 s.f.). | |
| **8** Solve $2^{2x} - 202^x + 36 = 0$.<br>Give exact roots, or 3 s.f. where the answer is not exact. | |
| **9** $f(x) = x^2 - 4x + 9$, $x \in \mathbb{R}$, and $g(x) = \frac{2}{x + 2}$, $x > -2$.<br>(a) Find the range of f.<br>(b) Show that gf is defined and find its range. | |
| **10** Water drains from a tank so that the depth h metres falls at a rate proportional to $\sqrt{h}$. Initially h = 25, and after 4 hours h = 1.<br>Form and solve a differential equation to find how long, in total, the tank takes to empty. | |