| Day 189 | A Level Maths: A Tier 10-a-day |
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| **1** Show by counter-example that the statement "The product of two irrational numbers is irrational" is false. | |
| **2** A and B have position vectors $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$. The point P lies on AB with AP : PB = 2 : 1. Find the position vector of P and the exact distance OP. | |
| **3** A ball is thrown vertically upwards at 24.5 m $s^{-1}$ from a point h m above horizontal ground, and hits the ground 7 s later. Find (a) h, (b) the greatest height above the ground. Take g = 9.8. | |
| **4** Solve $\cos 2x + 5\sin x = 3$ for $0 \leq x \leq 2\pi$. | |
| **5** Express $\frac{7x^2 + 22x - 8}{(x - 2)(x + 2)^2}$ in the form $\frac{A}{(x - 2)} + \frac{B}{(x + 2)} + \frac{C}{(x + 2)^2}$, and find A, B and C. | |

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| **6** The mean time taken (minutes) is normally distributed with standard deviation 5; it was previously 20.<br>A random sample of 16 has mean 22.3.<br>Test, at the 5% level, whether the mean has increased. | |
| **7** A uniform rod AB (20 kg, 2 m) is smoothly hinged at A to a vertical wall, with a 4 kg particle at B. A light string from B to the wall above A holds the rod horizontal, at angle $\theta$ to it, $\tan\theta = \frac{4}{3}$. Find (a) the tension, (b) the magnitude of the hinge force. Take g = 9.8. | |
| **8** X has pdf $f(x) = \frac{6}{8}x(2-x)$ for $0 \le x \le 2$, and 0 otherwise.<br>Find E(X), Var(X) and the standard deviation of X (3 s.f.). | |
| **9** Expand $(4-x)^{-\frac{1}{2}}$ in ascending powers of x, up to and including $x^2$.<br>State the range of x for which the expansion is valid. | |
| **10** A curve has equation $3x^2 + xy + 3y^2 = 105$.<br>Find the coordinates of the points where the tangent is parallel to the x-axis. | |