| Day 331 | A Level Maths: S Tier 10-a-day |
|---|---|
| **1** $g(x) = \sqrt{-x^2 + 7x - 10}$.<br>Find the largest possible domain of g, and the corresponding range. | |
| **2** The volume of a sphere increases at a constant rate of $128\pi$ $cm^3s^{-1}$.<br>When the radius is 4 cm, find the rate of increase of (a) the radius,<br>(b) the surface area. Volume = $\frac{4}{3}\pi r^3$. | |
| **3** A shell is projected from a point O on horizontal ground with speed 49 m $s^{-1}$ at an angle $\alpha$ above the horizontal, where $\tan\alpha = \frac{4}{3}$. Find (a) the greatest height, (b) the speed when it is at half of this height (3 s.f.). Take g = 9.8 m $s^{-2}$. | |
| **4** A manufacturer says that 25% of its screens have no flaws. A sample of 40 screens is checked, and 12 have no flaws.<br>Test, at the 5% significance level, the claim that the proportion is higher.<br>Give your conclusion in context. | |
| **5** Solve $x - 5\sqrt{x} + 4 = 0$. | |

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**6** The table shows the times, t minutes, taken by some runners.
Using linear interpolation, the median is estimated as 26.5 minutes. Find the value of k.

| t (min) | 0-10 | 10-20 | 20-30 | 30-40 | 40-60 |
|---|---|---|---|---|---|
| Frequency | k | 6 | 10 | 8 | 7 |

**7** The curve $y = 3x\sqrt[3]{252 - x}$, for $0 < x < 252$, has one
stationary point. Find its exact coordinates and determine its nature.

**8** $u_{n+1} = \frac{2}{3}u_n + 4$, $u_1 = 16$.
(a) Find the limit L of the sequence.
(b) Find the least n such that $|u_n - L| < 0.01$.

**9** A box of weight 75 N is pulled at constant speed up a line of greatest slope of a rough plane ($\tan\alpha = \frac{7}{24}$, $\mu = \frac{3}{4}$) by a force P N at angle β above the plane.
(a) Find P when $\tan\beta = \frac{4}{3}$. (b) Find the least possible value of P as β varies.

**10** Use integration by parts to find the exact value of
$\int_0^1 x^2 e^{-x}\,dx$