| Day 267 | A Level Maths: A Tier 10-a-day |
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| **1** Show by counter-example that the statement "$n^2 + n + 17$ is prime for all positive integers n" is false. | |
| **2** A ball is thrown vertically upwards at 39.2 m $s^{-1}$ from a point h m above horizontal ground, and hits the ground 12 s later. Find (a) h, (b) the greatest height above the ground. Take g = 9.8. | |
| **3** $f(x) = x^2 - 6$. Show that the Newton-Raphson formula gives $x_{n+1} = \frac{1}{2}(x_n + \frac{6}{x_n})$, and use it with $x_0 = 3$ to find $x_2$ as an approximation to $\sqrt{6}$, to 4 d.p. | |
| **4** The random variable X has $P(X = x) = k(6 - x)$ for x = 0, 1, 2, 3, 4. (a) Show that $k = \frac{1}{20}$. (b) Find E(X) and Var(X). (c) Find $P(X \geq 2)$. | |
| **5** The points A, B and C have coordinates (3, 5, 1), (−1, −3, −3) and (−2, −3, 1). Find angle ABC, in degrees to 1 d.p. | |

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| **6** For a sample of 11 pairs of values of time spent on social media and exam score, r = 0.605. The critical value for a two-tailed test at the 1% level is 0.7348. Test, at this level, whether there is any correlation between the two variables. | |
| **7** Water pours into a cone, vertex down, at 10 $cm^3s^{-1}$. The surface radius is always $\frac{h}{3}$. Find the rate at which the depth is rising when h = 10 cm. | |
| **8** Expand $(9 - 3x)^{-\frac{1}{2}}$ in ascending powers of x, up to and including $x^2$. State the range of x for which the expansion is valid. | |
| **9** The line $-3x + 4y = 34$ meets the circle $(x + 3)^2 + (y + 2)^2 = 49$ at the points A and B. Find the exact length of AB. | |
| **10** At t = 0, P and Q have position vectors $(-10\mathbf{i} - \mathbf{j})$ m and $(-\mathbf{i} - 4\mathbf{j})$ m and velocities $(3\mathbf{i} + 2\mathbf{j})$ m $s^{-1}$ and $(\mathbf{i} + \mathbf{j})$ m $s^{-1}$. Find (a) the time when they are closest, (b) the least distance between them. Give answers to 3 s.f. if not exact. | |