| Day 313 | A Level Maths: A Tier 10-a-day |
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| **1** A systematic sample is taken from a numbered list of 420 items.<br>The 4th item chosen is number 43 and the 8th item chosen is number 91.<br>Find the sampling interval, the number of the first item chosen and the size of the sample. | |
| **2** A 1500 kg car tows a 200 kg trailer by a light tow-bar on a horizontal road. Driving force 1250 N; resistances 300 N (car), 100 N (trailer). Find (a) the acceleration and the tow-bar tension. At 8 m $s^{-1}$ the tow-bar breaks. (b) How far does the trailer then travel? | |
| **3** A is acute and B is obtuse, with $\sin A = \frac{8}{17}$ and $\cos B = -\frac{3}{5}$.<br>Find the exact values of cos(A+B) and sin(A+B). | |
| **4** A(−1, −3) and B(−7, 5) are the ends of a diameter of a circle.<br>(a) Find the equation of the circle, in the form $x^2 + y^2 + ax + by + c = 0$.<br>(b) Show that C(0, 4) lies on the circle. | |
| **5** n = 8 pairs of (x, y): $\Sigma x = 177$, $\Sigma y = 446$, $\Sigma x^2 = 4231$, $\Sigma xy = 10328$.<br>(a) Find the equation of the regression line of y on x (3 s.f.).<br>(b) Estimate y when x = 25. | |

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| **6** A particle is projected up a line of greatest slope of a smooth plane inclined at $\alpha$. It passes A, 17.15 m from the start, after 2 s and again after 7 s. Find (a) the speed of projection, (b) $\alpha$ to 1 d.p. Take g = 9.8. Give answers to 3 s.f. if not exact. | |
| **7** Find the coefficient of $x^3$ in the expansion of $(2x^2 + \frac{2}{x})^9$. | |
| **8** $\theta$ is obtuse and $\sin\theta = \frac{15}{17}$.<br>Find the exact values of $\sin 2\theta$, $\cos 2\theta$ and $\tan 2\theta$. | |
| **9** By writing 15° as 45° − 30°, find the exact value of<br>$\cos 15°$, in the form $\frac{\sqrt{a} \pm \sqrt{b}}{c}$. | |
| **10** $f(x) = \frac{7x - 3}{(1 - x)(1 + x)}$.<br>(a) Express f(x) in partial fractions.<br>(b) Hence expand f(x) up to $x^2$.<br>(c) State the range of x for which the expansion is valid. | |