| Day 305 | A Level Maths: A Tier 10-a-day |
|---|---|
| **1** $\theta$ is acute and $\tan\theta = \frac{5}{2}$.<br>Show that $\cos 2\theta = -\frac{21}{29}$ and find the exact value of $\sin 2\theta$. | |
| **2** Forces $F_1 = (-6\mathbf{i} - 9\mathbf{j})$ N, $F_2 = (-6\mathbf{i} + 8\mathbf{j})$ N and $F_3 = (a\mathbf{i} + b\mathbf{j})$ N keep a 3 kg particle in equilibrium. Find (a) a and b. $F_2$ is then removed; (b) find the magnitude of the acceleration. Give answers to 3 s.f. if not exact. | |
| **3** $f(x) = x^2 - 6x + 6$.<br>(a) Write f(x) in the form $a(x + p)^2 + q$.<br>(b) State the minimum value of f(x) and the value of x at which it occurs.<br>(c) Solve $f(x) = 0$, giving surds in simplest form. | |
| **4** For n = 10 pairs of (x, y): $\Sigma x = 180$, $\Sigma y = 572$, $\Sigma x^2 = 3736$, $\Sigma y^2 = 36062$, $\Sigma xy = 11522$.<br>Calculate the product moment correlation coefficient, and describe the correlation. | |
| **5** Expand $(1 + x)^{-\frac{3}{2}}$ in ascending powers of x up to and including the term in $x^2$.<br>State the range of values of x for which the expansion is valid. | |

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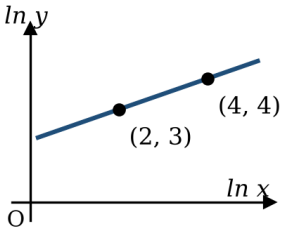
**6** The table summarises the mass, m grams, of eggs.
Estimate the mean and standard deviation (3 s.f.).

| Class | Frequency |
|---|---|
| $0 \le m < 5$ | 16 |
| $5 \le m < 10$ | 15 |
| $10 \le m < 15$ | 10 |
| $15 \le m < 20$ | 2 |
| $20 \le m < 25$ | 9 |

**7** (a) Express $9 \sin x - 12 \cos x$ in the form $R \sin(x - \alpha)$, where $R > 0$ and $0° < \alpha < 90°$. Give $\alpha$ to 1 d.p.
(b) Solve $9 \sin x - 12 \cos x = -9$ for $0° \le x < 360°$, giving answers to 1 d.p.

**8** $u_1 = 36$ and $u_{n+1} = \frac{1}{2} u_n + 9$.
(a) Find the limit L of the sequence as $n \to \infty$.
(b) Find the least n for which $|u_n - L| < 0.01$.

**9** The diagram shows the graph of ln y against ln x for $y = A x^n$.
Find the value of n and the exact value of A.




**10** Particle A (6 kg) rests on a smooth table, joined by a light string over a smooth pulley at the edge to particle B (1 kg), hanging 1.2 m above the floor. Released from rest. Find (a) the tension, (b) the speed of B as it hits the floor. Take g = 9.8. Give answers to 3 s.f. if not exact.