| Day 326 | A Level Maths: A Tier 10-a-day |
|---|---|
| **1** Solve $\cos 2\theta + \sin\theta = -2$ for $0° \leq \theta \leq 360°$. | |
| **2** A circle has equation $x^2 + y^2 - 6x + 12y + 16 = 0$.<br>(a) Find the centre and radius of the circle.<br>(b) Determine whether P(3, −6) lies inside or outside the circle. | |
| **3** Forces $F_1 = (\mathbf{i} + 8\mathbf{j})$ N, $F_2 = (-15\mathbf{i} - 8\mathbf{j})$ N and $F_3 = (a\mathbf{i} + b\mathbf{j})$ N keep a 5 kg particle in equilibrium. Find (a) a and b. $F_2$ is then removed; (b) find the magnitude of the acceleration. | |
| **4** $\lvert a\rvert = 2$, $\lvert b\rvert = 7$ and the angle between a and b is 135°.<br>Find the exact values of $a \cdot b$ and $\lvert a + b\rvert$. | |
| **5** Expand $(1 + x)^{\frac{1}{2}}$ 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 height, h cm, of seedlings.
Estimate the mean and standard deviation (3 s.f.).

| Class | Frequency |
|---|---|
| $20 \le h < 30$ | 16 |
| $30 \le h < 40$ | 5 |
| $40 \le h < 50$ | 5 |
| $50 \le h < 60$ | 7 |
| $60 \le h < 70$ | 18 |

**7** A stone is projected from a cliff top 8.1 m above the sea at 15 m $s^{-1}$, at angle α above the horizontal, $\tan\alpha = \frac{4}{3}$. Find (a) the time to reach the sea, (b) the horizontal distance travelled, (c) the speed on impact. Take g = 9.8. Give answers to 3 s.f. if not exact.

**8** In the expansion of $(1 + kx)^n$, where n is a positive integer, the coefficient of x is 12 and the coefficient of $x^2$ is 66.
Find n and k.

**9** $l_1$: $\mathbf{r} = \begin{pmatrix}3\\1\\3\end{pmatrix} + \lambda\begin{pmatrix}-3\\0\\-2\end{pmatrix}$
$l_2$: $\mathbf{r} = \begin{pmatrix}-9\\-5\\-3\end{pmatrix} + \mu\begin{pmatrix}2\\3\\1\end{pmatrix}$
Determine whether $l_1$ and $l_2$ intersect. If they do, find the point of intersection.

**10** X ~ B(32, p). $H_0$: p = 0.3 is tested against $H_1$: p < 0.3 using a 5% significance level.
(a) Find the critical region. (b) State the probability of a Type I error.
(c) Find the probability of a Type II error when p = 0.15 (3 s.f.).