Day 156 **A Level Maths: A Tier 10-a-day**

1 The curve y = f(x) has a maximum point at (−2, −2).
Find the coordinates of the corresponding point on:
(a) y = f(x) + 2
(b) y = −f(x)
(c) y = f(−x)

2 The life of a battery is $N(70, 8^2)$. A battery is classed as 'special' if its life is more than 55. 10 batterys are chosen at random. Find the probability that exactly 3 are special (3 s.f.).

3 The equation $x^2 + (k)x + (2k) = 0$ has no real roots.
Find the set of possible values of k.

4 A, B and C have position vectors $\begin{pmatrix} -3 \\ 3 \\ 0 \end{pmatrix}$, $\begin{pmatrix} -5 \\ 4 \\ -2 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ k \\ 2 \end{pmatrix}$
relative to O, where k is a constant. Given that A, B and C are collinear, find k and the ratio AB : BC.

5 The table summarises the mass, m kg, of parcels of 51 items.
Use linear interpolation to estimate the 90th percentile.

Class	Frequency
$0 \le m < 10$	13
$10 \le m < 20$	16
$20 \le m < 30$	10
$30 \le m < 40$	6
$40 \le m < 50$	6

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6 A non-uniform rod AB (length 2 m, mass 4 kg) has its centre of mass at G, AG = 0.25 m. It hangs horizontally from vertical strings at A and B. A particle of mass m kg is fixed at P, AP = 1.5 m, making the tensions equal. Find (a) m, (b) the tension. Take g = 9.8.

7 Find the term independent of x in the expansion of

$(2x^3 + \frac{3}{x^2})^5$.

8 The line l has equation $\mathbf{r} = \begin{pmatrix} 0 \\ 10 \\ 7 \end{pmatrix} + t\begin{pmatrix} 0 \\ -3 \\ -1 \end{pmatrix}$.

Find the coordinates of the foot of the perpendicular from P(1, 1, 4) to l, and the exact distance from P to l.

9 A uniform rod AB (16 kg, 3 m) is smoothly hinged at A to a vertical wall, with a 3 kg particle at B. A light string from B to the wall above A holds the rod horizontal, at angle θ to it, $\tan\theta = \frac{4}{3}$. Find (a) the tension, (b) the magnitude of the hinge force. Take g = 9.8. Give answers to 3 s.f. if not exact.

10 The circle has centre O and radius 18 cm.

Angle AOB = $\frac{\pi}{2}$.

Find the exact area and the exact perimeter of the shaded segment.

