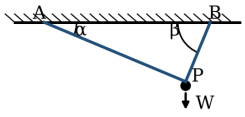
Day 204	A Level Maths: S Tier 10-a-day

1 $f(x) = x^3 + 4x^2 + 10x + 12$.
Show that $(x + 2)$ is a factor of $f(x)$, and that the equation $f(x) = 0$ has exactly one real root.

2 (a) Express $3\cos\theta + 4\sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p.
(b) Hence solve $3\cos\theta + 4\sin\theta = 3$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.

3 Solve simultaneously:
$x - 2y = 3$
$2x^2 - xy + y^2 = 18$

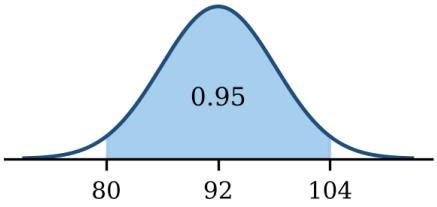
4 A particle P of weight 104 N hangs in equilibrium from two light strings AP and BP attached to a horizontal ceiling at A and B (see diagram), where $\tan\alpha = \frac{5}{12}$ and $\tan\beta = \frac{12}{5}$.
Find (a) the tension in each string, (b) the greatest weight P could have if neither tension may exceed 156 N.



5 Solve $|x - 5| \leq |-4x - 5|$.

Day 204 **A Level Maths: S Tier 10-a-day**

6 The pdf of $X \sim N(92, \sigma^2)$ is shown; the shaded area is symmetrical.
(a) Find σ. (b) Find $P(X > 109)$.



7 A curve has parametric equations $x = 2(\theta - \sin\theta)$, $y = 2(1 - \cos\theta)$.
Find the exact area under one arch, for $0 \leq \theta \leq 2\pi$,
between the curve and the x-axis.

8 $f(\theta) = \dfrac{3}{20 + 5\sin\theta + 12\cos\theta}$
(a) Write $5\sin\theta + 12\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$.
(b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.

9 A car of mass 1500 kg, with engine power 14.82 kW, climbs a straight road with $\sin\alpha = \frac{1}{20}$ against a constant resistance of 500 N.
Find (a) the greatest steady speed up the hill,
(b) the acceleration at 3 m s^{-1}. Take $g = 9.8$ m s^{-2}.

10 A biased spinner lands on 'win' with the same unknown probability p each time. It is used 5 times in round 1 and 8 times in round 2.
Given that exactly 6 wins occur altogether, find the probability that exactly 4 of them were in round 1.