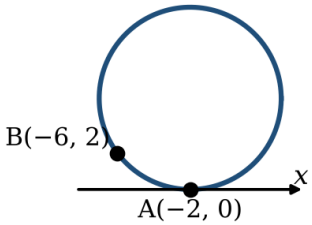
Day 340	A Level Maths: A Tier 10-a-day
1 The random variable X has P(X = x) = k(7 − x) for x = 2, 3, 4, 5, 6. (a) Show that k = $\frac{1}{15}$. (b) Find E(X) and Var(X). (c) Find P(X ≥ 4).	
2 The equation $e^x = 4x + 5$ has a root α. Use the iteration $x_{n+1} = \ln(4x + 5)$ with $x_0 = 3$ to find x_1, x_2 and x_3 to 4 d.p., and hence the value of α to 2 d.p. (continue until the 2 d.p. value is settled).	
3 A particle of mass 3 kg is acted on by forces $\mathbf{F}_1 = (-\mathbf{i} + 12\mathbf{j})$ N and $\mathbf{F}_2$. Its acceleration is $(-3\mathbf{i} - \mathbf{j})$ m s^{-2}. Find (a) $\mathbf{F}_2$, (b) the angle between $\mathbf{F}_2$ and $\mathbf{i}$, to 1 d.p.	
4 $g(\theta) = \frac{1}{18 + 15\sin\theta + 8\cos\theta}$ (a) Write 15 sin θ + 8 cos θ in the form R sin(θ + α), with α acute. (b) Find the greatest and least values of g(θ) and the smallest positive θ at which the greatest value occurs (1 d.p.).	
5 $f(x) = x^2 + 4x + 10$, $x \geq -2$. Find $f^{-1}(x)$ and state its domain.	

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6 A 4 kg particle rests on a smooth plane inclined at α, $\tan\alpha = \frac{5}{12}$, held by a string in the vertical plane through a line of greatest slope, at angle θ above the slope, $\tan\theta = \frac{5}{12}$. Find the tension and the normal reaction. Take g = 9.8. Give answers to 3 s.f. if not exact.

7 The diagram shows a circle that touches the x-axis at A(−2, 0) and passes through B(−6, 2).
Find the equation of the circle.



8 X ~ B(26, p). H_0: p = 0.3 is tested against H_1: p ≠ 0.3 at the 5% level.
(a) Find the critical region.
(b) Find the actual significance level of the test (3 s.f.).

9 θ is small and measured in radians. Use small angle approximations to show that
$3\sin 2\theta + \cos 3\theta = 2$
can be written as $a\theta^2 + b\theta + c = 0$ with integers a, b, c. Hence find the approximate solution with $0 < \theta < 0.8$, to 3 s.f.

10 (a) Expand $(1 + x)^{\frac{1}{2}}$ in ascending powers of x up to x^2.
(b) Use x = 0.02 to estimate $\sqrt{102}$ to 4 decimal places.