Day 251	A Level Maths: B Tier 10-a-day

1

Points A and B have position vectors $\begin{pmatrix} -2 \\ 3 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} 4 \\ 5 \\ 7 \end{pmatrix}$.

Find AB and the distance AB.

2

The circle C has equation $(x + 1)^2 + (y + 2)^2 = 50$.

The point P$(-8, -3)$ lies on C.

Find an equation of the tangent to C at P, in the form $ax + by + c = 0$ with integer a, b, c.

3

Use the substitution $u = x^2 + 3$ to find the exact value of

$$\int_0^6 \frac{x}{\sqrt{x^2 + 3}}\, dx.$$

4

A sequence is defined by $u_{n+1} = -2u_n + 4$, $u_1 = 6$.

(a) Find u_2 and u_3.

(b) Find $\sum_{r=1}^{4} u_r$.

5

A car of mass 800 kg tows a trailer of mass 200 kg along a straight horizontal road by a light horizontal tow bar. The resistances are 300 N on the car and 200 N on the trailer.

The engine's driving force is 2000 N. Find the acceleration and the tension in the tow bar.

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6 (a) Expand $(1 + 2x)^{-\frac{1}{3}}$ in ascending powers of x up to and including the term in x^3. (b) State the range of values of x for which the expansion is valid.	
7 Find the exact value of $\arcsin(\sin \frac{3\pi}{4})$.	
8 A block of mass 3 kg is released from rest on a rough plane inclined at angle α to the horizontal, where $\tan \alpha = \frac{3}{4}$. The coefficient of friction is 0.25. Take g = 9.8 m s^{-2}. Find the acceleration down the plane, and the distance moved in 4 s.	
9 The continuous random variable X has pdf $f(x) = \frac{2x}{100}$ for $0 \leq x \leq 10$, and 0 otherwise. (a) Find $P(X > 4)$. (b) Find the median of X, to 3 significant figures.	
10 $X \sim B(80, 0.2)$. Use a normal approximation to find $P(17 \leq X \leq 20)$, to 3 significant figures.	