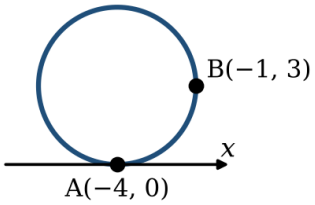
| Day 284 | A Level Maths: A Tier 10-a-day |
|---|---|
| **1** A particle moves on the x-axis. At time t s its acceleration is $(3t - 6)$ m $s^{-2}$. When t = 0 it is at O with velocity 4 m $s^{-1}$. Find (a) its velocity when the acceleration is zero, (b) its displacement from O then. | |
| **2** The equation $x^2 + (k + 1)x + (2k + 2) = 0$ has no real roots.<br>Find the set of possible values of k. | |
| **3** P(A) = 0.65, P(B) = 0.3 and $P(A \cap B) = 0.05$.<br>Find<br>(a) $P(A \cup B)$<br>(b) $P(A' \cap B')$<br>(c) $P(A \mid B')$ | |
| **4** Particles A (2 kg) and B (4 kg) move in the same direction on a smooth horizontal line at 6 m $s^{-1}$ and 6 m $s^{-1}$. They collide and coalesce. Find (a) the speed of the combined particle, (b) the kinetic energy lost in the collision. | |
| **5** On each independent trial, the probability that a biased die shows a six is $\frac{1}{10}$.<br>X is the number of trials up to and including the first success.<br>(a) Find P(X = 5) and E(X).<br>(b) Find the least m with $P(X \leq m) > 0.9$. | |

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**6** The region bounded by the curve $y = e^{3x}$, the x-axis, $x = 0$ and $x = 2$ is rotated through 360° about the x-axis.
Find the exact volume of the solid formed.

**7** The diagram shows a circle that touches the x-axis at A(−4, 0) and passes through B(−1, 3).
Find the equation of the circle.




**8** $l_1: \mathbf{r} = \begin{pmatrix} 4 \\ 6 \\ 1 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 3 \\ -1 \end{pmatrix}$

$l_2: \mathbf{r} = \begin{pmatrix} -2 \\ 0 \\ 3 \end{pmatrix} + \mu \begin{pmatrix} -1 \\ 3 \\ -3 \end{pmatrix}$

Determine whether $l_1$ and $l_2$ intersect. If they do, find the point of intersection.

**9** Solve $x(\sqrt{2} - 4) = 5 + 4\sqrt{2}$, writing x in the form $p + q\sqrt{2}$.

**10** Water drains from a tank so that the depth h metres falls at a rate proportional to $\sqrt{h}$. Initially $h = 16$, and after 5 hours $h = 9$.
Form and solve a differential equation to find how long, in total, the tank takes to empty.