| Day 196 | A Level Maths: S Tier 10-a-day |
|---|---|
| **1** $f(x) = \frac{18}{x^2 + 4x + 6}$ for all real x.<br>Find the greatest value of f(x), the value of x at which it occurs, and the range of f. | |
| **2** Car P passes a point O travelling at a constant speed of 10 m $s^{-1}$. 5 s later, car Q leaves O from rest with constant acceleration 3 m $s^{-2}$, travelling in the same direction.<br>Q overtakes P at the point X. Find (a) the time Q takes to reach X, (b) the distance OX, (c) the speed of Q at X. | |
| **3** Express $\frac{28x^2 - 126x + 136}{(x - 4)(2x - 4)^2}$ in the form $\frac{A}{(x - 4)} + \frac{B}{(2x - 4)} + \frac{C}{(2x - 4)^2}$. | |
| **4** For 30 observations x, $\Sigma(x - 20) = 30$ and $\Sigma(x - 20)^2 = 630$.<br>(a) Find the mean of x.<br>(b) Find the standard deviation of x.<br>(c) Find the value of $\Sigma x^2$. | |
| **5** The first row of a theatre has 13 seats. Each row has 3 more seats than the row in front. Find<br>(a) the number of seats in row 56,<br>(b) the least number of rows for at least 574 seats. | |

| Day 196 | A Level Maths: S Tier 10-a-day |
|---|---|

**6** For events A and B, P(A) = 0.15, P(B) = 0.15 and P(A | B) = 0.6.
(a) Find P(A ∩ B).
(b) Find P(A | B′).

**7** Use integration by parts to find the exact value of

$$\int_0^1 xe^x \, dx$$

**8** $f(\theta) = \dfrac{4}{21 + 8\sin\theta + 15\cos\theta}$
(a) Write $8\sin\theta + 15\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$.
(b) Find the greatest and least values of $f(\theta)$, and the smallest positive $\theta$ at which the greatest value occurs, to 1 d.p.

**9** A particle P moves on a straight line. At time t = 0, P passes through the fixed point O with velocity 96 m $s^{-1}$. At time t seconds, P has acceleration $(6t - 44)$ m $s^{-2}$.
Find (a) the times at which P is at O again, (b) the greatest distance of P from O before it first returns to O.

**10** The line l has equation $\mathbf{r} = \begin{pmatrix} -1 \\ -2 \\ 3 \end{pmatrix} + t\begin{pmatrix} 0 \\ -2 \\ 3 \end{pmatrix}$.
The point P has coordinates $(0, -4, -7)$.
Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF.