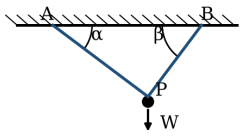
Day 259	A Level Maths: S Tier 10-a-day

1 An arrow is projected from a point O on horizontal ground with speed 24.5 m s^{-1} at an angle α above the horizontal, where $\tan\alpha = \frac{4}{3}$. Find the horizontal distance between the two points at which the arrow is 14.7 m above the ground. Take g = 9.8 m s^{-2}.

2 Find the set of values of x for which both $x^2 - 3x - 10 \geq 0$ and $2x - 4 \geq 2$.

3 A cone with its vertex downwards and semi-vertical angle α, where $\tan\alpha = \frac{1}{2}$, is filled at 15π cm^3s^{-1}. Find the rate at which the depth h is rising when h = 4 cm. ($V = \frac{1}{3}\pi r^2 h$)

4 A particle P of weight 129 N hangs in equilibrium from two light strings AP and BP attached to a horizontal ceiling at A and B (see diagram), where $\tan\alpha = \frac{3}{4}$ and $\tan\beta = \frac{4}{3}$. Find (a) the tension in each string, (b) the greatest weight P could have if neither tension may exceed 111.2 N.



5 Express $\frac{7 - 2\sqrt{3}}{2 + 2\sqrt{3}}$ in the form $p + q\sqrt{3}$, where p and q are rational numbers.

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6 $X \sim B(30, \frac{1}{4})$.

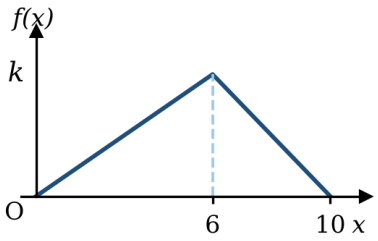
(a) Show that $P(X = r + 1) \div P(X = r) = \frac{30 - r}{r + 1} \times \frac{1}{3}$.

(b) Find the most likely value of X and its probability (3 s.f.).

7 The points A, B, C have coordinates $(0, -3, 0)$, $(-2, 4, 5)$, $(1, 5, -1)$.
Find angle ABC to 1 d.p., and the exact area of triangle ABC.

8 Express $\frac{2x^3 - 6x^2 - 10x + 34}{(x - 3)(x - 2)}$ in the form $ax + b + \frac{C}{(x - 3)} + \frac{D}{(x - 2)}$.

9 The diagram shows the pdf of X.
Find (a) k, (b) E(X), (c) the median of X (3 s.f.).



10 The line l has equation $\mathbf{r} = \begin{pmatrix} 7 \\ 3 \\ -3 \end{pmatrix} + t\begin{pmatrix} 2 \\ -1 \\ -3 \end{pmatrix}$.
The point P has coordinates (12, 6, 4).
Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF.