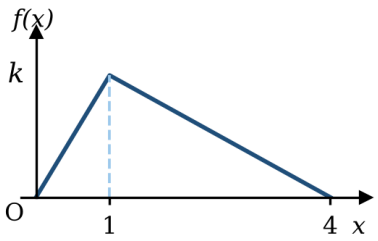
| Day 106 | A Level Maths: S Tier 10-a-day |
|---|---|

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




**2** A cone with its vertex downwards and semi-vertical angle α, where $\tan\alpha = \frac{1}{2}$, is filled at $4\pi$ cm$^3$s$^{-1}$. Find the rate at which
the depth h is rising when h = 6 cm. ($V = \frac{1}{3}\pi r^2 h$)

**3** A geometric series has sum to infinity 16 and second term 3. Find the possible values of the common ratio r and the first term a in each case.

**4** A lift of mass 350 kg, carrying a passenger of mass 70 kg, is supported by a vertical cable. The lift is moving downwards and accelerating at 2.4 m s$^{-2}$.
Find (a) the force the floor exerts on the passenger, (b) the tension in the cable. Take g = 9.8 m s$^{-2}$.

**5** (a) Express $12\cos\theta + 9\sin\theta$ in the form $R\cos(\theta - \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p.
(b) Hence solve $12\cos\theta + 9\sin\theta = 12$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.

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| **6** Two ships A and B move with constant velocities. At time t = 0 hours, A is at $(8\mathbf{i} - 3\mathbf{j})$ km relative to a fixed origin and B is at $(6\mathbf{i} + 8\mathbf{j})$ km. A has velocity $(4\mathbf{i} + 2\mathbf{j})$ km $h^{-1}$ and B has velocity $(7\mathbf{i} - 2\mathbf{j})$ km $h^{-1}$.<br>Find (a) the time at which the ships are closest together, (b) the least distance between them. | |
| **7** $f(x) = x^3 + x^2 - x - 8$.<br>(a) Show that $f(x) = 0$ has a root $\alpha$ with $1 < \alpha < 2$.<br>(b) Use Newton-Raphson with $x_0 = 2$ to find $x_1$ and $x_2$<br>to 4 decimal places. | |
| **8** The curve C has parametric equations $x = 2t$, $y = 4t^2$. The line $y = -4x + 32$ meets C at A and B. Find the exact length AB. | |
| **9** Large Data Set, daily total rainfall (mm), Camborne, August 2015 (n = 92): mean 3.1, sd 6.8. (1 inch = 25.4 mm)<br>(a) Find the mean and sd in inches.<br>(b) Is a reading of 20.1 more than 2 sd above the mean? | |
| **10** Given that $\sqrt{5}$ is irrational, prove by contradiction that $9 + 2\sqrt{5}$ is irrational. | |