**Day 278** **S Tier 10-a-day**

**1** A virus has a diameter of $2 \times 10^{-7}$ metres.
Viruses are placed in a straight line, touching, to make a length of $1.86 \times 10^{-3}$ metres.
How many viruses are in the line?
Give your answer in standard form.

**2** The table shows the number of students in each of four groups.
(a) A stratified sample of 35 is taken. Work out how many come from Year 10.
(b) A different stratified sample has 30 from Year 8. Work out the size of this sample.

| | Year 7 | Year 8 | Year 9 | Year 10 |
|---|---|---|---|---|
| Number | 175 | 250 | 250 | 200 |

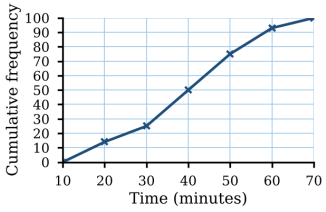
**3** Factorise fully $x^4 - 256$

**4** A sector of a circle has angle 150° and area $\frac{245}{12}\pi$ cm$^2$.
(a) Work out the radius of the circle.
(b) Work out the length of the arc of the sector.
Give your answer to (b) in terms of $\pi$.

**5** (a) Show that the equation $x^2 - 9x - 16 = 0$ can be rearranged to give $x = 9 + \frac{16}{x}$
(Calculator)
(b) Use the iteration formula $x_{n+1} = 9 + \frac{16}{x_n}$ with $x_0 = 10$ to work out $x_1$ and $x_2$. Give each answer correct to 3 decimal places.

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**6** The cumulative frequency graph gives information about the times of 100 students to complete a puzzle.
(a) Find an estimate for the median and the interquartile range.
(b) Estimate how many of the 100 had a time greater than 15.




**7** In one country, income tax is worked out like this:
The first £12,500 of income is not taxed.
The next £20,000 is taxed at 20%.
All income above that is taxed at 45%.
Priya earns £42,500 in a year.
Work out how much income tax Priya pays.

**8** The table gives information about the times of some people.
Work out an estimate for the mean time.
Give your answer correct to 1 decimal place.
(Calculator)

| Time, t (minutes) | Frequency density |
|---|---|
| $0 < t \leq 10$ | 0.4 |
| $10 < t \leq 20$ | 0.6 |
| $20 < t \leq 40$ | 1.6 |
| $40 < t \leq 60$ | 2 |

**9** OA = $\mathbf{a}$ and OB = $\mathbf{b}$.
OP = $2\mathbf{a} - 2\mathbf{b}$, OQ = $-\mathbf{a} - \mathbf{b}$ and OR = $-13\mathbf{a} + 3\mathbf{b}$.
(a) Show that P, Q and R lie on a straight line.
(b) Work out the ratio PQ : QR in its simplest form.

**10** Prove algebraically that the difference between the squares of any two odd numbers is a multiple of 8.