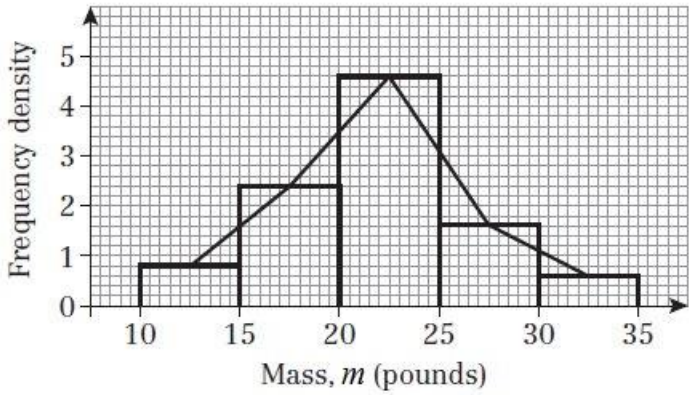
Representations of data 3D

1 a Class widths are all 5.

Frequency densities are: 0.8, 2.4, 4.6, 1.6, 0.6



2 a Time is a continuous variable.

b Area of 60 to 70 seconds bar is $10\times6=60$ square units.

1 square unit $=\frac{90}{60}=1.5$ students

The area of the 40 to 60 seconds bar is $20\times5=100$ square units.

So there were $100\times1.5=150$ students who took between 40 and 60 seconds.

c Area for 80 seconds or less $=20\times5+10\times6+10\times8.6=246$ square units.

So there were $246\times1.5=369$ students who took 80 seconds or less.

d Total Area $=246+5\times14+5\times12+30\times3=466$ square units.

So there are $466\times1.5=699$ employees in total.

3 a Distance is a continuous variable.

b Area for less than 20 m is $20\times2=40$ square units.

1 square unit $=\frac{80}{40}=2$ people

Total Area = $20\times2+15\times5+10\times10+15\times6+5\times1=310$ square units.

So $310\times2=620$ people entered the competition.

c Area for 30 to 40 m is $5\times5+5\times10=75$ square units.

So $75\times2=150$ people threw between 30 and 40 metres.

3 d Area for 45 to 65 m is $15\times6+5\times1=95$ square units.

So $95\times2=190$ people threw between 45 and 65 metres.

e Area for less than 25 m is $10\times2+10\times2+5\times5=65$ square units.

So $65\times2=130$ people threw less than 25 metres.

4 a The bar for $28 \leqslant m < 32$ has an area of $10 \times 10 = 100$ squares.
If 100 squares represents 32 pigs then
$\frac{100}{4}$ squares represents $\frac{32}{4}$ pigs.
i.e. 25 squares represents 8 pigs.

b The class $24 \leqslant m < 26$ contains $5 \times 20 = 100$ squares.
As above, this represents 32 pigs.

c The class $20 \leqslant m < 24$ contains $10 \times 10 = 100$ squares which represents 32 pigs.

The class $24 \leqslant m < 26$ contains $5 \times 20 = 100$ squares which represents 32 pigs.

The class $26 \leqslant m < 28$ contains $5 \times 40 = 200$ squares which represents 64 pigs.

The class $28 \leqslant m < 32$ contains $10 \times 10 = 100$ squares which represents 32 pigs.

The class $32 \leqslant m < 34$ contains $5 \times 5 = 25$ squares which represents 8 pigs.

So in total we have $32 + 32 + 64 + 32 + 8 = 168$ pigs.

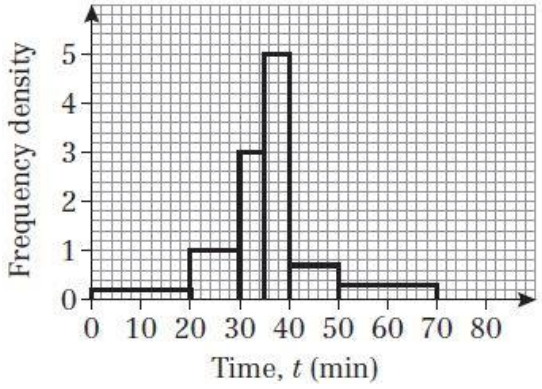
d Class $25 \leqslant m < 26$ is approximately $\frac{1}{2}$ of class $24 \leqslant m < 26$ which equates to 16 pigs.
Class $26 \leqslant m < 28$ represents 64 pigs.
Class $28 \leqslant m < 29$ is approximately $\frac{1}{4}$ of class $28 \leqslant m < 32$ which equates to 8 pigs.

So in total we have $16 + 64 + 8 = 88$ pigs.

5 a i Use extra columns to help, using the frequency densities given in the histogram:

Time, *t* (min)	**Frequency**	**Class width**	**Frequency density**
$0 \leqslant t < 20$	4	20	0.2
$20 \leqslant t < 30$	$10 \times 1 = 10$	10	1
$30 \leqslant t < 35$	15	5	3
$35 \leqslant t < 40$	25	5	5
$40 \leqslant t < 50$	$10 \times 0.7 = 7$	10	0.7
$50 \leqslant t < 70$	$20 \times 0.3 = 6$	20	0.3

5 a ii



b $\left(\frac{5}{10}\times 10\right)+15+\left(\frac{3}{5}\times 25\right)=35$ passengers.

6 a 12.5 and 14.5 are the class boundaries, as we are dealing with continuous data.

b i The class boundaries for the 15–17 class are 14.5 and 17.5.
This width is 1.5 times the width of the 13–14 class, since 17.5 – 14.5 = 3 = 1.5 x 2.
So the width of the class is 1.5 × 4 = 6 cm.

ii The frequency density for the 13–14 class is $\frac{24}{2}=12$.

The frequency density of this class is 6, which is 0.5 times the frequency density above: 12.
So the height of the class is 0.5 x 6 = 3 cm.

7 a Width is half of the $8 \leqslant t < 10$ class, which is 0.5 cm.

Height is double the frequency density, so must be $\frac{7}{1}\times 2$ = 14 cm.

b Mean = $\frac{\sum fx}{\sum f} = \frac{322.5}{31}$ = 10.4°C (to 1 d.p.) where x is taken as the midpoint of each class.

Standard deviation = $\sqrt{\frac{\sum fx^2}{\sum f}-\left(\frac{\sum fx}{\sum f}\right)^2} = \sqrt{\frac{3530.75}{31}-\left(\frac{322.5}{31}\right)^2}$ = 2.4 (to 1 d.p.)

c Q_1 is the $\frac{1\times 31}{4}$ = 7.75th piece of data.

$\frac{Q_1-8}{10-8}=\frac{7.75-4}{12-4}$ using linear interpolation on the $8 \leq t < 10$ class.

Q_1 = 8.9°C (to 1 d.p.)

d Mean + standard deviation = 12.8°C (to 1 d.p.)

$\frac{12.8-12}{15-12}=\frac{d-25}{30-25}$

d = 26.33
$31 - d = 4.67$, so 5 days.