1.   ABCDEF is a solid prism.
       ABCD is a rectangle with AB = 4cm and BC = 5cm.
       ABF and DCE are congruent right-angled triangles.
       AF is 9cm.
       Find the volume of the prism.
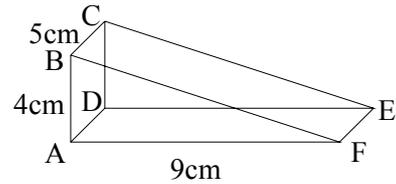
       3 marks

2.   A sequence begins 0, 3, 8, 15,…,…,
       a)   What are the next two numbers of the sequence?

       A different sequences begins –3, 0, 3, 6, 9,…,…
       b)   i)   Formulate an expression for the nth term in terms of n.
                ii)   Calculate the 100th and 101st terms.

       5 marks

3.   Look at the diagram to the right–
       a)   Write down an equation linking x and y only.
       b)   Write down an equation linking x, y and z.
       c)   Find z.
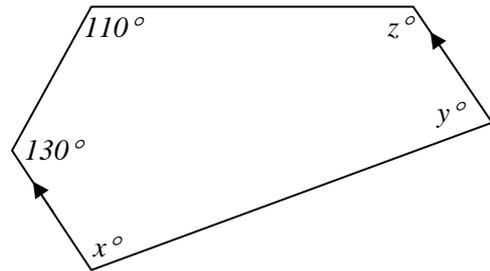
       5 marks

4.   Bag A contains 4 green balls and 7 yellow balls
       Bag B contains 7 green balls and 2 yellow balls.
       A ball is selected from each bag.
       Calculate the probability that both balls are yellow.

       2 marks

5.   *Copy the diagram before you start.*
       a)   Reflect the triangle in the line $x = –1$ and label your new triangle A'B'C'.
       b)   Rotate the <u>original</u> triangle ABC, 180^0 clockwise, about the point (0,2) and label your new triangle A"B"C".
       c)   Enlarge the <u>original</u> triangle ABC, by a scale factor 2, using (2,3) as the centre of enlargement.
                Label your new triangle A'''B'''C'''.
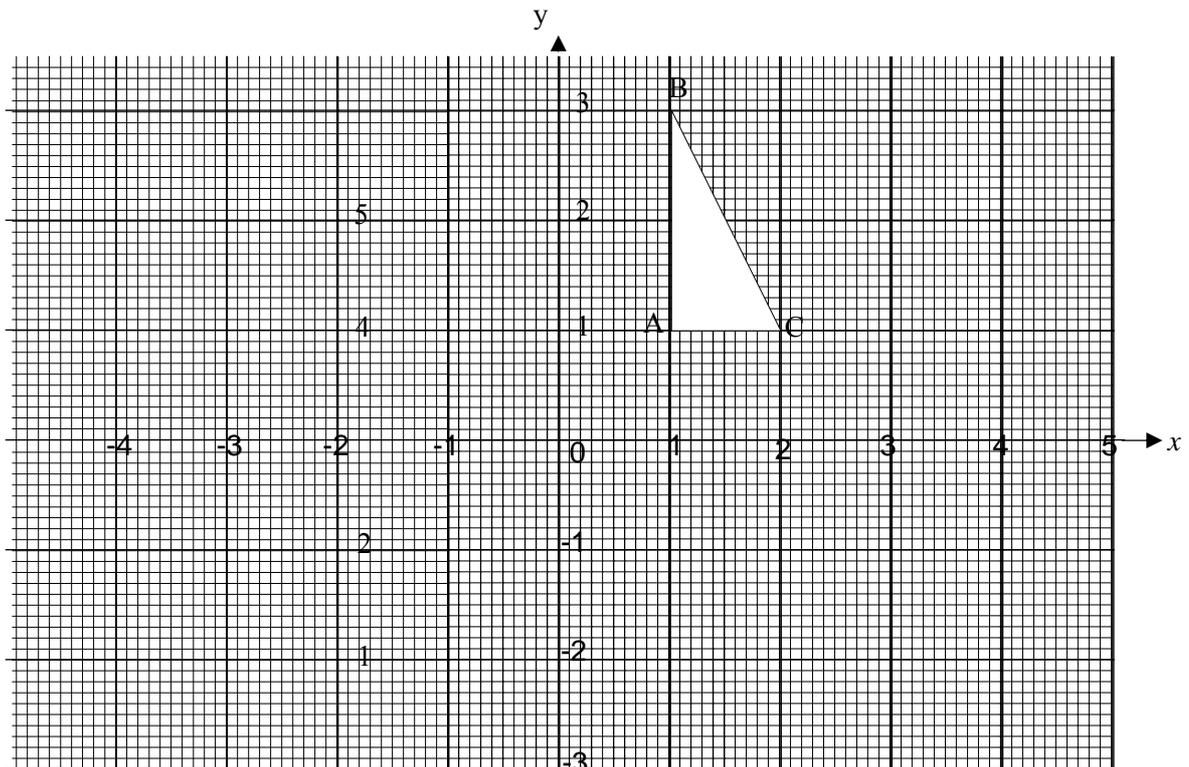
       The point A is reflected in the line y = 44 and becomes D.

d)   What would the co-ordinates of D be?   7 marks

6.   Solve the simultaneous linear equations:

$$3y - 2x = 4.8$$
$$3x - 2y = 3.8$$

       5 marks

7.   a)   Write 148 as the product of primes.
       b)   Write 148^{10} as the product of primes.   3 marks

8.   Jane flies at 30 km/hour from A to B.
       a)   What bearing should she be flying on?
       b)   How long to the nearest minute should the journey take?
    During her flight she realises that there are some problems with the helicopter's instruments.
    Jane does not know how far she has travelled and Jane does not know in what direction she has been travelling.
    It is known that Jane is within 10km of C.
       c)   Shade the possible positions that Jane might be.

North

SCALE
1cm to 5km

C╳

╳A
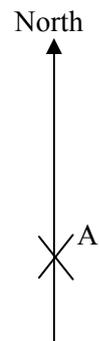
B
╳

5 marks

9.   This cumulative frequency graph shows the running distances of the members of a running club, during the first week of training.
       a)   How many runners did not run that week?
       b)   How many runners ran 40 or more miles?
       c)   Calculate the inter-quartile range.

6marks

Cumulative Frequency — Distance Run (Miles)
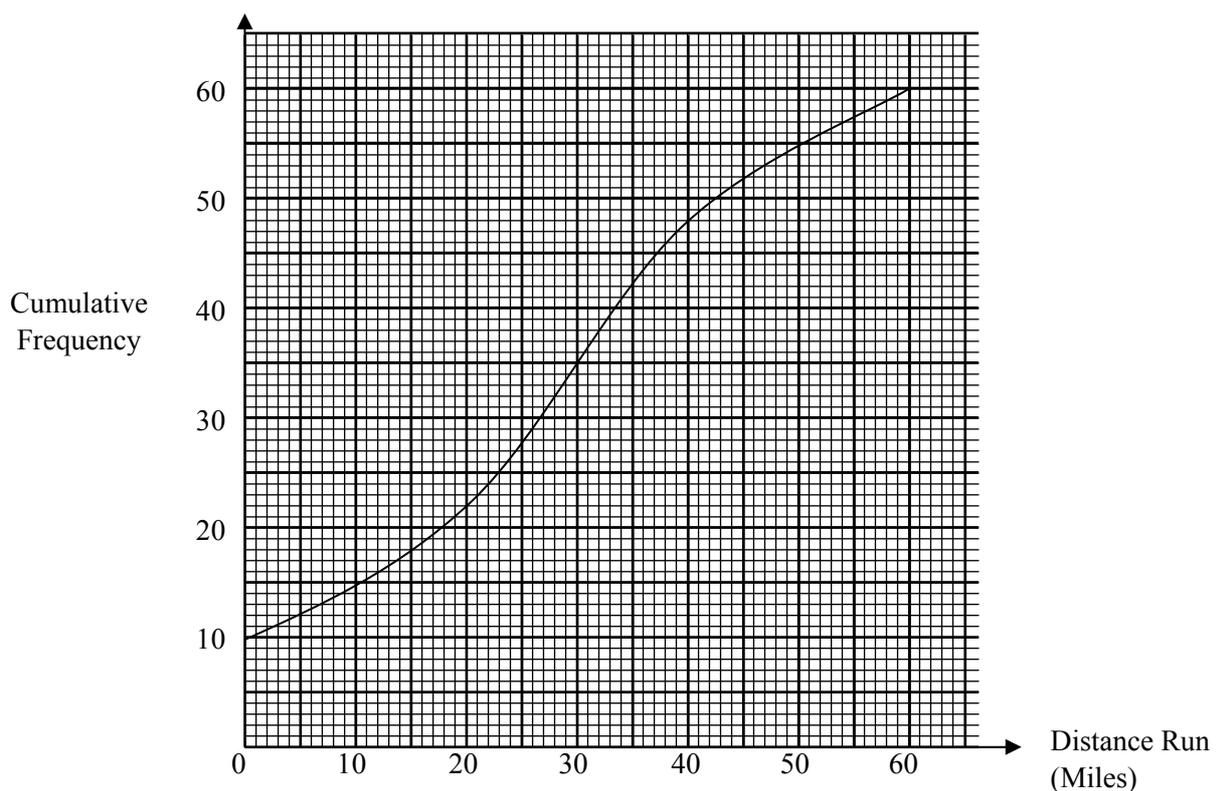
10. a) $p = qr$ with $q = 3\sqrt{2}$ and $r = 2\sqrt{12}$. Find p exactly, in simplified surd form.

b) Calculate r^3 exactly simplifying your answer. 9 marks

c) Calculate an expression for the volume of this cylinder in the form $\dfrac{a\pi\sqrt{b}}{c}$, with a, b, c integers and where your answer is as simplified as far as possible.

√3cm

√2cm
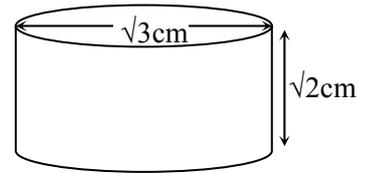
11. The histogram below gives information about the heights, in cm, of the Year 10 students at a secondary school.

Using the histogram, copy and complete the frequency table shown to the right.

Height (*h* cm)	Frequency
$140 \leq h < 150$	
$150 \leq h < 160$	20
$160 \leq h < 180$	
$180 \leq h < 200$	

Frequency Density

Height (*h* cm)
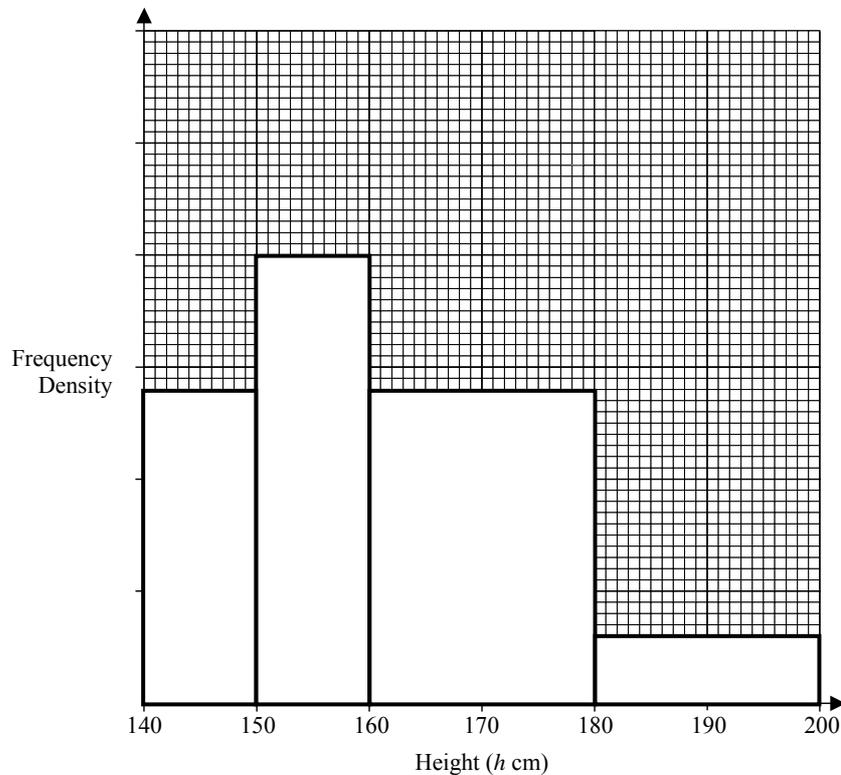
4 marks

12. Simplify–

a) $p^q \times p^{2q}$

b) $3 \times p^0$ 3 marks

13. The amount of caesium-137 in a radioactive sample decreases at a rate of 2.28% per year.
A radioactive source has 10,000 caesium-137 atoms.
How many caesium-137 atoms are present in the source after 15 years? 4 marks

14. Solve the following simultaneous equations:

$4x - 3y = 34$
$y^2 - 2x = -10$ 5 marks

15. A motorcyclist starts the day with 20 litres of fuel in his tank, correct to the nearest litre.
At the end of the day, he has travelled 96.2 miles, correct to the nearest 0.1 miles, and the tank is empty.
   a) Calculate the least amount of fuel that the motorcyclist could be starting with at the beginning of the day.
   b) Calculate the least distance the motorcyclist could have travelled by the end of the day.
   c) Calculate the least upper bound for the motorcycle's fuel efficiency in miles per litre, correct to 5 significant figures.

5 marks

16. A glass sheet is to be made. The longest width measures $x + 2$ metres, the longest height measures x metres and the missing corner measures $1m \times 2m$ as shown.
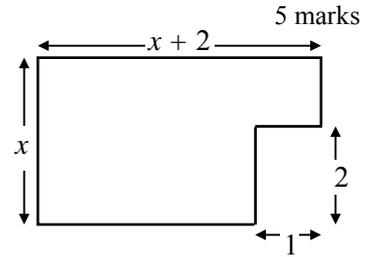
   a) Show that the area of the glass can be expressed in metres squared as $x^2 + 2x - 2$.

The area of the glass sheet is $24m^2$.
   b) Using a quadratic equation find the value of x to 2 decimal places and justify ignoring negative values x in your final answer.   5 marks

17. In a physics experiment, the resistance of a filament, r was monitored while the temperature, t of the filament was altered. The resistance was found to be proportional to the square of the temperature. When the filament was at a temperature of 280 Kelvin, the resistance was 25Ω.
   a) Give an equation for r in terms of t, evaluating any constants.
   b) The temperature is increased to 340 Kelvin.
      What is the resistance of the filament?
   c) The scientists want the filament to operate with a resistance not more than 15Ω.
      What is the maximum temperature the wire should be kept at to achieve this?   7 marks

18. Three research ships are investigating whale migration.
The ship *Hope* is due North of the ship *Wake*.
Reach is 60km from *Wake* on a bearing of 060°.

Wake departs on a bearing of 060°. At the same time, *Hope* travelling faster than *Wake* moves to meet with *Wake* by travelling on a collision course on a bearing of 135°.
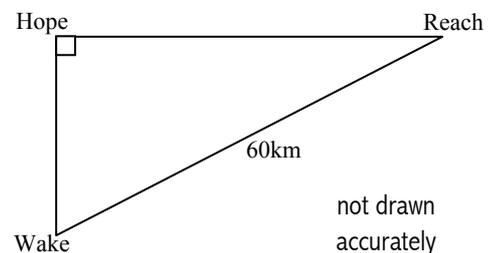
Wake and Hope meet 1 hour later. Calculate the distance Wake and Hope travel before they meet. 7 marks

19. ABCD is a tetrahedron, with D directly above A.
AB = 7.5cm, AC = 18cm and AD = 25.5cm.
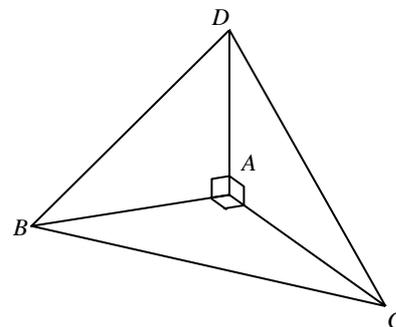
   a) Calculate–
      i) BC in cm to 1 decimal place.
      ii) DB in cm to 1 decimal place
      iii) DC in cm to 1 decimal place

   b) Find the size of angle BDC to 1 decimal place.   7 marks

20. Lee and Jon are playing a game of chance. Lee has a fair four sided dice, and Jon a fair six sided dice. If Jon throws a six, and Lee doesn't throw a four, Jon wins. If Lee throws a four, and Jon doesn't throw a six, Lee wins. Any other result is a draw. *Give your answers to this question exactly in simplified fraction form.*

   a) What is the probability that the first throw of the two dice results in a draw?
   b) What is the probability that the first three throws of the two dice all result in draws?   4 marks