Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify $n^3 \times n^5$

(b) Simplify $\dfrac{c^3d^4}{c^2d}$

.....

(2)

(c) Solve $\dfrac{5x}{2} > 7$

(Total for Question 1 is 5 marks)

4 It takes 14 hours for 5 identical pumps to fill a water tank.

How many hours would it take 4 of these pumps to fill another water tank of the same size?

..... hours

(Total for Question 4 is 2 marks)

19 Show that $\frac{3x}{x+2} - \frac{2x+1}{x-2} - 1$ can be written in the form $\frac{ax+b}{x^2-4}$ where a and b are integers.

(Total for Question 19 is 4 marks)

7 Here are the equations of four straight lines.

Line A $y = 2x + 4$
Line B $2y = x + 4$
Line C $2x + 2y = 4$
Line D $2x - y = 4$

Two of these lines are parallel.

Write down the two parallel lines?

Line ..... and line .....

(Total for Question 7 is 1 mark)

19 $R = \dfrac{P}{Q}$

$P = 5.88 \times 10^8$ correct to 3 significant figures.
$Q = 3.6 \times 10^5$ correct to 2 significant figures.

Work out the lower bound for R.
Give your answer as an ordinary number correct to the nearest integer.
You must show all your working.

(Total for Question 19 is 3 marks)

14 At the start of 2022 Kim invested some money in a savings account.
The account paid 3.5% compound interest each year.

At the end of 2022
interest was added to the account then Kim took £750 from the account.

At the end of 2023
interest was added to the account then Kim took £1000 from the account.

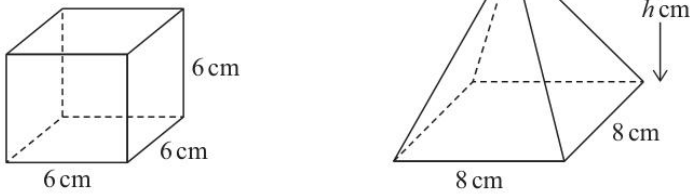
There was then £2937.14 in the account.

Work out how much money Kim invested at the start of 2022
You must show all your working.

£.....

(Total for Question 14 is 4 marks)

9 The diagram shows a cube and a square-based pyramid.



The volume of the cube is equal to the volume of the pyramid.

Work out the perpendicular height, h cm, of the pyramid.

(Total for Question 9 is 3 marks)

13 An expression for the nth term of the sequence of triangular numbers is $\frac{n(n+1)}{2}$

Prove that the sum of any two consecutive triangular numbers is a square number.

(Total for Question 13 is 3 marks)

5 A and B are numbers such that

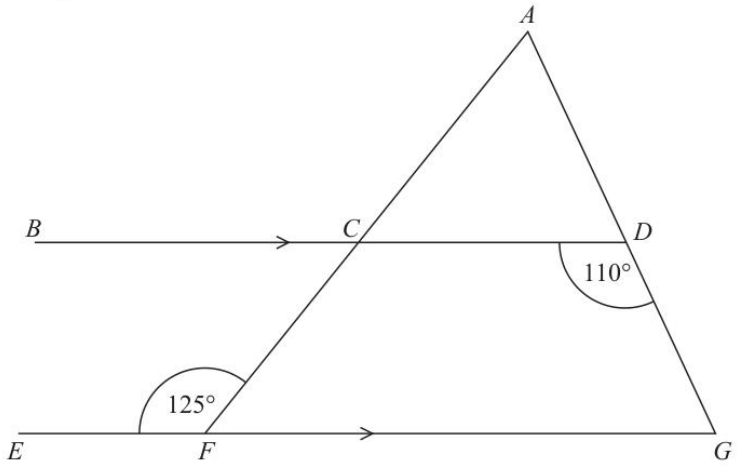
$$A = 2^2 \times 3^4 \times 7$$
$$B = 3^2 \times 7^2$$

(a) Find the highest common factor (HCF) of A and B.

(b) Find the lowest common multiple (LCM) of A and B.

(Total for Question 5 is 3 marks)

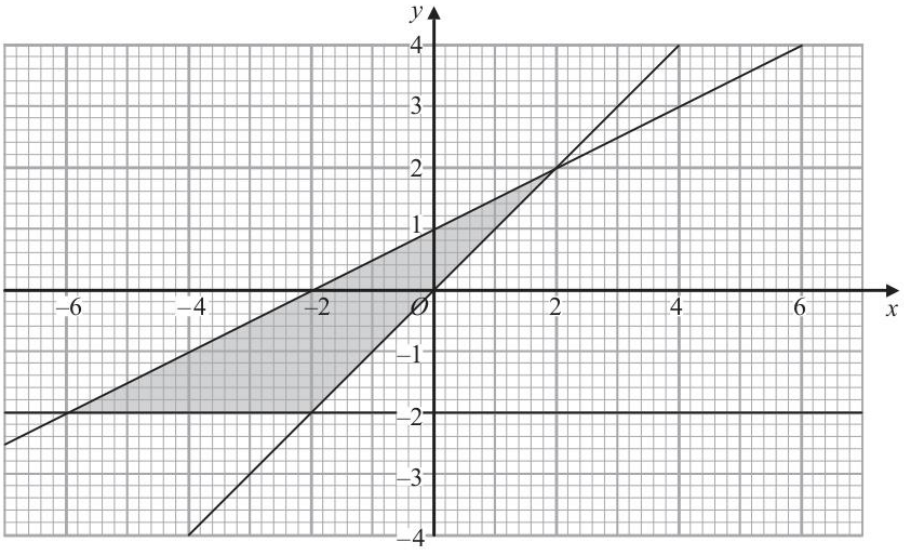
3 *ACF* and *ADG* are straight lines.
BCD and *EFG* are parallel lines.



Show that triangle *ACD* is isosceles.
Give a reason for each stage of your working.

(Total for Question 3 is 5 marks)

13



Write down the three inequalities that define the shaded region.

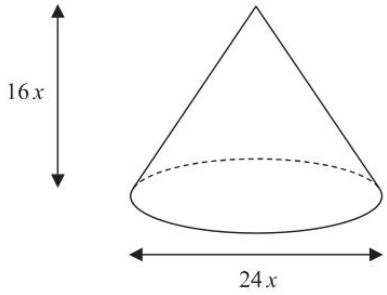
.....

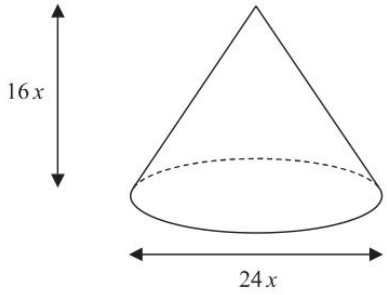
.....

.....

(Total for Question 13 is 4 marks)

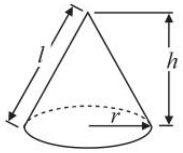
17 The diagram shows a solid cone.





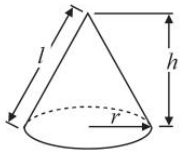
Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$



The diameter of the base of the cone is $24x$ cm.
The height of the cone is $16x$ cm.

The curved surface area of the cone is 2160π cm^2.
The volume of the cone is $V\pi$ cm^3, where V is an integer.

Find the value of V.

(Total for Question 17 is 5 marks)

14 Write

$$4 - \left[(x + 3) \div \frac{x^2 + 5x + 6}{x - 2} \right]$$

as a single fraction in its simplest form.
You must show your working.

(Total for Question 14 is 4 marks)

4 Jenny works in a shop that sells belts.

The table shows information about the waist sizes of 50 customers who bought belts from the shop in May.

Belt size	Waist (w inches)	Frequency
Small	$28 < w \leqslant 32$	24
Medium	$32 < w \leqslant 36$	12
Large	$36 < w \leqslant 40$	8
Extra Large	$40 < w \leqslant 44$	6

(a) Calculate an estimate for the mean waist size.

.....inches

(3)

Belts are made in sizes Small, Medium, Large and Extra Large.

Jenny needs to order more belts in June.
The modal size of belts sold is Small.

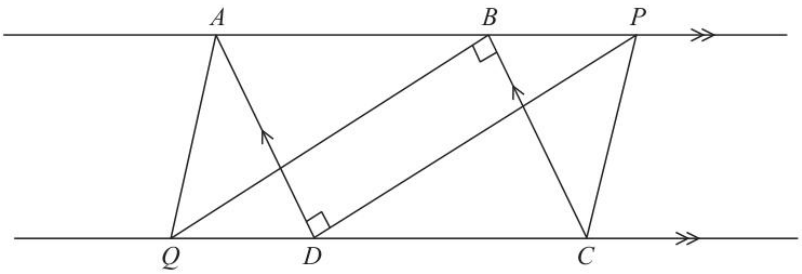
Jenny is going to order $\frac{3}{4}$ of the belts in size Small.

The manager of the shop tells Jenny she should **not** order so many Small belts.

(b) Who is correct, Jenny or the manager?
You must give a reason for your answer.

(Total for Question 4 is 5 marks)

21



ABCD is a parallelogram.
ABP and *QDC* are straight lines.
Angle *ADP* = angle *CBQ* = 90°

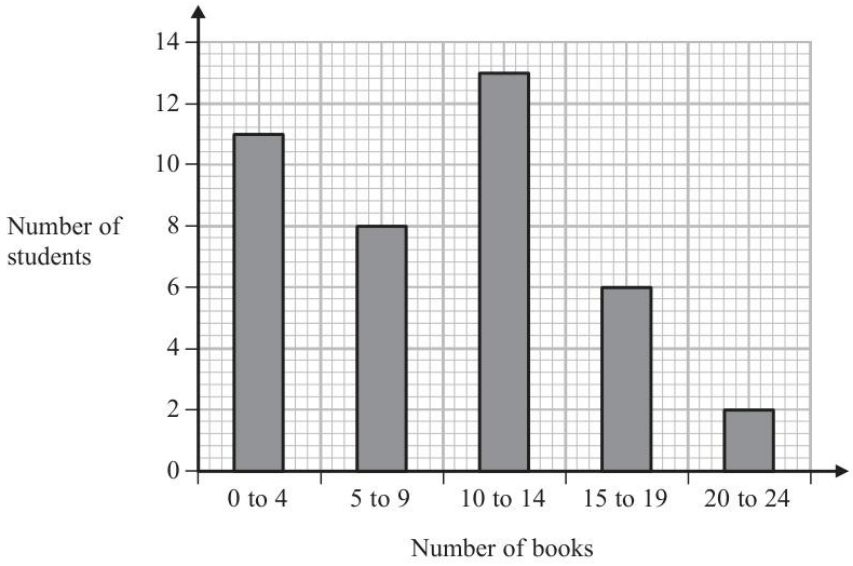
(a) Prove that triangle *ADP* is congruent to triangle *CBQ*.
(b) Explain why *AQ* is parallel to *PC*.

(2)

(Total for Question 21 is 5 marks)

4 Fran asks each of 40 students how many books they bought last year.

The chart below shows information about the number of books bought by each of the 40 students.



(a) Work out the percentage of these students who bought 20 or more books.

.....%

(2)

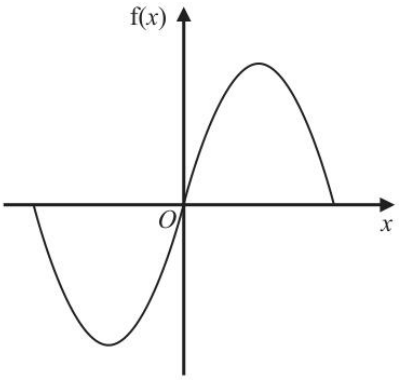
(b) Show that an estimate for the mean number of books bought is 9.5
You must show all your working.

(4)

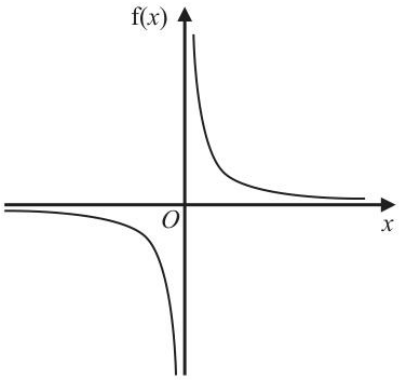
(Total for Question 4 is 6 marks)

17 Here are four graphs.

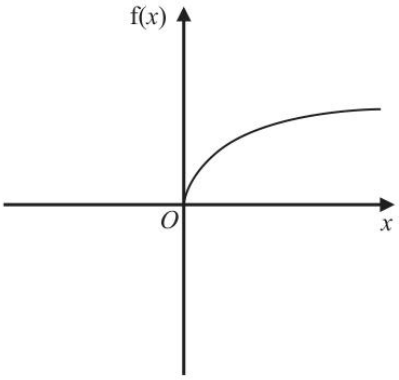
Graph A



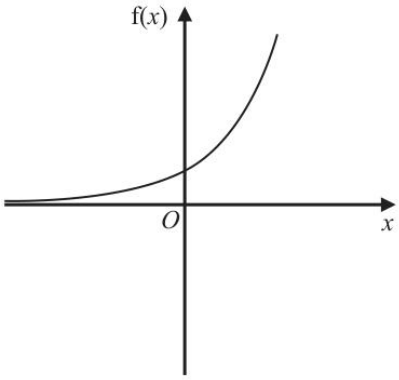
Graph B



Graph C



Graph D



The graphs represent four different types of function f.

Match each description of the function in the table to the letter of its graph.

Description of function	**Graph**
f(x) is inversely proportional to x	
f(x) is a trigonometrical function	
f(x) is an exponential function	
f(x) is directly proportional to $\sqrt{x}$	

(Total for Question 17 is 2 marks)

DO NOT WRITE IN THIS AREA

14 A group of people went to a restaurant.
Each person chose one starter and one main course.

starter	main course
soup	lasagne
prawns	curry

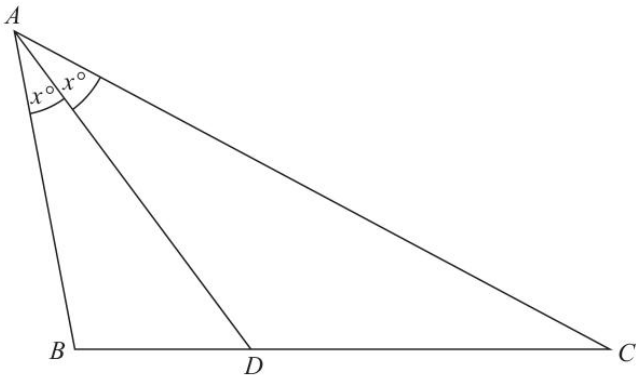
the number of people who chose soup : the number of people who chose prawns = 2 : 3

Of those who chose soup,
the number of people who chose lasagne : the number of people who chose curry = 5 : 3
Of those who chose prawns,
the number of people who chose lasagne : the number of people who chose curry = 1 : 5

What fraction of the people chose curry?
You must show how you get your answer.

(Total for Question 14 is 4 marks)

23 ABC is a triangle.



D is the point on BC such that angle BAD = angle $DAC = x°$

Prove that $\frac{AB}{BD} = \frac{AC}{DC}$

(Total for Question 23 is 4 marks)

2 Natalie makes potato cakes in a restaurant.

She mixes potato, cheese and onion so that

weight of potato : weight of cheese : weight of onion = 9 : 2 : 1

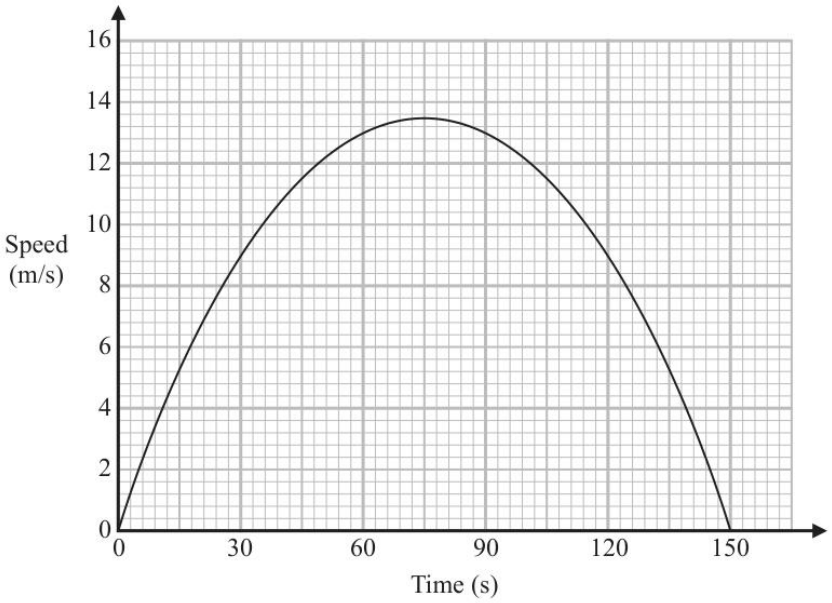
Natalie needs to make 6000 g of potato cakes.

Cheese costs £2.25 for 175 g.

Work out the cost of the cheese needed to make 6000 g of potato cakes.

(Total for Question 2 is 4 marks)

16 Here is a speed-time graph for a car.



(a) Work out an estimate for the distance the car travelled in the first 30 seconds.

..... m

(2)

(b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 30 seconds?
Give a reason for your answer.

.....

.....

.....

(1)

Julian used the graph to answer this question.

Work out an estimate for the acceleration of the car at time 60 seconds.

Here is Julian's working.

$$\text{acceleration} = \text{speed} \div \text{time}$$

$$= 13 \div 60$$

$$= 0.21\dot{6} \text{ m/s}^2$$

Julian's method does not give a good estimate of the acceleration at time 60 seconds.

(c) Explain why.

.....

.....

.....

(1)

(Total for Question 16 is 4 marks)