Think like a problem solver and mathematician book.
Version 1

Name_____

This book was created from worksheets I wrote for my students. The questions gradually mix basic maths with more quirky questions to get students thinking rather than just rote learning formulae and facts.

The exercises generally last between 1 and 2 hours and in later exercises marks are given to simulate exam style questions.

The questions were originally written for the AQA Foundation GCSE Linked Pair Methods and Applications syllabus but are certainly useful for other exams.

There is no set order to topics and I'm sure there are some odd mistakes in there. Hopefully you will find the booklet helpful though and students will start to think how to answers tougher exam questions!

Please contact me in the site if there are any changes that need to be made. The book doesn't come with worked solutions or answers! Teachers can make those! I did these exercises with my students as we went.
Feel free to use it in your school, send it to parents or upload it to school websites.

(1) Gary and Fred find some money. They find 4 **different** coins. Gary takes some of the money. He has 7p more than Fred. Write down the coins Gary and Fred could each have,

(2) Sue thinks of an **even** number. Complete the table below

Statement	True	Possibly True	False
The number is positive			
The number is a multiple of 2			
The number is a square number			
The number is a factor of 8			
The number is odd			
The number is a prime number			
The number is divisible by 2			
One of the factors of the number is odd			

(3) Pete has some beads. Some are black and some are white. The ratio of black to white is 2:3. He has less than 10 black beads. What is the maximum number of white beads he could have?

(4) Arrange the number cards below to make the largest value possible. You can only use each number once and each mathematical sign once. You must have a number followed by a sign. 643 for example is not allowed but $3 \times 4 + 6$ is allowed.
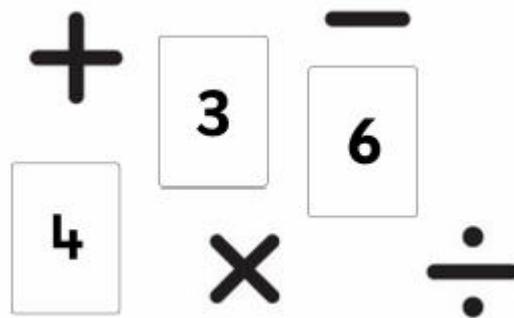
(5) Find 2 positive **and** 2 negative numbers that sum to give 10.

(6) For every 4 chairs Paul has he needs 3 tables. Given he has 27 tables how many chairs does he need?

(7) Insert 5 **different** numbers into the squares below such that the column (vertical) adds to double the row (horizontal)
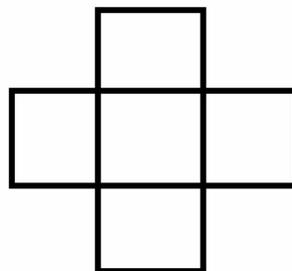

(8) Pete and Sue have some lemonade. Pete gives 250ml to Sue which leaves her with double what she started. Sue drinks 1/10 of her lemonade. How much more lemonade would she need to now make a litre?

(9) Given 2p – 3q = 10, write an expression for the number (a) 100 (b) 30 and (c) -10

(10) John works for a digging company. He gets £21.50 (after tax) if he completes a days work. He only gets paid if he completes a days work. His pay packet (after tax) is £424.50. Show there is an error in his wages.

(1) Bob has 4 different coins in his pocket. They add to 28p. He takes two coins out of his pocket and puts one different coin in. What is the maximum amount he can now have in his pocket?

(2) Find the value of D given the following facts

$A = 2B + 1$ $C = 4$ $B = 3 + C$ $D = A - C$

(3) Add the (a) 3rd square number to (b) the 5th prime number to (c) the second smallest cube number.

(4) Show that the shape below tessellates by continuing the pattern using at least 5 more shapes.
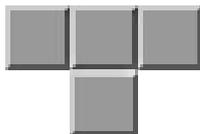
(5) Rearrange the cards below to find the difference between the highest possible value and the lowest possible value.
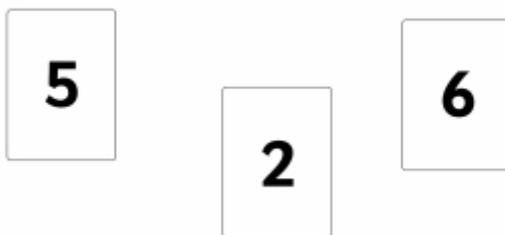
(6) Find the HCF and LCM of 8 and 12

(7) Work out the maximum number of small blocks that can fit into the larger block shown below.
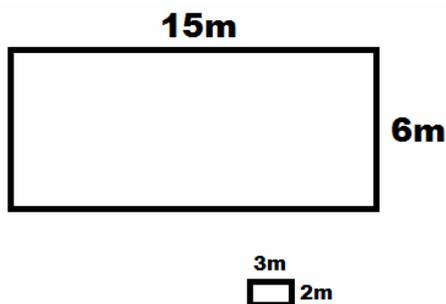
(8) John can buy a cup cake for 80p of 5 for £3.10. Find the cheapest way of buying 24 cupcakes.

(9) There are 5 counters in a bag. The counters are either white or black. The probability of choosing a black is 0.4. One of the black counters is removed and replaced by a white. What is the probability of choosing a black after the switch?

(10) 56 people go to a party. 24 take food, 12 take drink and 8 take both food and drink. Find the probability of someone from the party going without food or drink.

(1) To make one cake Fred needs each of the following:
25g of sugar, 30g of flour and 10ml of milk.
He has 250g of sugar, 240g of flour and 75ml of milk. Find the maximum number of cakes he can make from the ingredients he has.

(2) Study the shapes below.

(a) Circle two of the shapes that are congruent.
(b) Show that the two shapes you have circled tessellate buy drawing at least 5 of them.
(c) State the common volume of each shape.
A box that measures 8 x 4 x 2 is used to pack the 4 x 1'straight' shape above.
(d) Find out the maximum number of the shapes will fit in the box.

(3) (a) On the circle below draw and label (*i*) the centre (*ii*) a diameter (*iii*) a radius (*iv*) a chord and (*v*) a tangent.
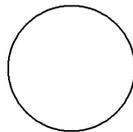
(b) The circle is a garden with a radius of 5m. Fred the gardener needs to put a circular fence around the outside. The fencing is sold in 2m packs and costs £31.25 per pack. Find the cost of fencing the garden.

(4) Here is a list of numbers: 2, 6, 22, 14, 13, 16, 17, 27
From the list of numbers above, write down:
   (a) The prime number(s)
   (b) The Cube number(s)
   (c) The square number(s)
   (d) The factor(s) of 24
   (e) The multiple(s) of 11

(5) Below is a table containing the letters A,B, C and D and the numbers 1,2,3 and 4.

	1	2	3	4
A				9
B				
C				
D			7	3

Fill out as much of the table as you can given the following:
A1 = 2   B1 = 5 times A1   C2 = twice B1   C2 = C3   D3 = 3 times C2   B4 = B1

(6) A train leaves Station A every 20 minutes starting at 9am. It takes 1 hr 27 minutes for the train to get from Station A to Station B. Fred needs to be at Station B for 14:15. What is the latest train he can get from Station A to be there on time*?*

(7) In a supermarket cans of beans are on display. There is one can in the front row, 2 in the second, 3 in the third, 4 in the forth and so on.
(a) Find how many rows are needed to have at least 24 cans in total on display.
(b) Show that there are no more than 12 cans in the first 4 rows.

(1) Jill buys some seeds. There are 50 seeds and 80% blossom into flowers. She can sell each flower for 80p. The seeds costs her £6.70 Find how much profit she would make if she sold all of the flowers.

(2) Draw a rectangle with an area of 10cm² and hence draw a triangle with an area of 10cm²

(3) Draw a hexagon, cuboid, semi circle, trapezium, kite and isosceles triangle.

(4) Draw a 47 degree angle and state the name given to angles greater than 0 degrees but less than 90 degrees.

(5) Petrol costs £1.08 a litre and John's car does 10 miles to the litre. He drives 124 miles. What is the maximum the journey will cost him?

(6) £1 = \$1.6. Find (a) how many \$ you would get for £40 and (b) how many £ you would get for \$48.

(7) Put one set of brackets in the calculation below to make it true:

$$3 + 5 \times 7 + 1 = 57$$

(8) Given $p = 3$ put these in order (smallest first)   (a) p^2 (b) $2p$ (c) $(p-1)^2$ (d) $3p-4$

(9) A bath in the shape of a cuboid measures 1m by 2m by 3m. (a) Find the volume of the bath and (b) sketch the bath.

(10) Explain what the difference between an equilateral and isosceles triangle is.

(11) Explain why angle z in the picture below is 80 degrees
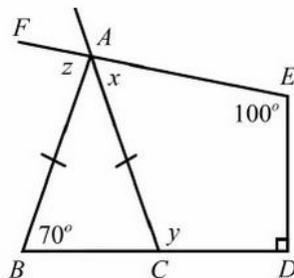
(12) Find two numbers that multiply to give 60 and add to give 17

(13) The probability of Sue winning a game of darts is 0.4. If she plays 100 games how many would you expect her to lose? (She can either win or lose. She can't draw)

(14) Show that 25% of £44 is more than 10% of £111.

(15) Sketch a cube with a volume of 27cm³

(16) 43 people go to a party. 20 take a partner and 37 bring a bottle of wine. Given 5 go with neither a partner nor wine find the number of people who go with a partner and wine.

(17) Fred walks 4km east, then 9km west. How far from his starting position does he end and on what bearing?

(18) Draw a shape with (a) rotational order symmetry of 2 and (b) a shape with line symmetry 4.

(19) In a test Fred scored 23/25. What was his score as a percentage?

(20) A can of coke costs 64p. A six pack of coke costs £3.20. Find the cheapest way of buying at least 28 cans.

(1) (a) The nth term of a sequence is given by $3n - 1$. Find the first 4 terms in the sequence.
(b) A different sequence has the first 4 terms 7, 11, 15 and 19. Find the nth term for the sequence.

(2) Mark all of the points more than 1km from the point X but no more than 2km away from X. Use the scale 1cm = 1km.

.X

(3) Write down the difference between the largest & smallest non integer in the list: 2, 1.7, 14, 6.95, 7, 4, 11, ½

(4) Draw a square with an area of half of the area of rectangle below.

12.5m

4m
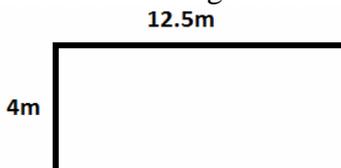
(5) Without using a calculator find the value of 27 x 312

(6) A square has the vertices A (1,1), B (1,3), C (3,3) and D (x,y). The square is translated by (2,1) write down the coordinates of the vertices after the square has been translated.

(7) Find 3 prime numbers that sum to give 23.

(8) A garden is in the shape of a triangle. The dimensions are 4m by 10m. The garden needs grassing. Each box of grass seed cover 6 square meters and costs £3.92. Find the cost of grassing the garden.

(9) Complete the table below using the following information:
C1 = 2(A1)   C1=C3   A2=¼(B3)   A3=C2   B2=B1=2³

	A	B	C
1	5		
2			12
3		20	

(10) Expand and simplify the following (a) 2(x-1)   (b) 3x(x+6)   (c) 4(x+1) + 3(x-1)

(11) John has the choice of two mobile phone contracts:
Plan 1 - £30 fixed charge with unlimited calls, texts and data
Plan 2 - £5 fixed charge. Calls are charged at 10p per minute. Texts are 2p each and data is £10 per MB
John uses 3 hours of calls, 120 texts and no internet data one month. Advise John which plan he should take showing full workings.

(12) The table below shows the number of families who own iPads and iPhones. In the table families own either 1, 2 or 3 iPhones or 1, 2 or 3 iPads

|	1 iPhone	2 iPhones	3 iPhones
1 iPad	3	1	2
2 iPads	5	4	5
3 iPads	1	2	3

(a) How many families own at least 2 iPads?
(b) How many families own less than 3 iPhones?
(c) How many families own 2 iPads and more than 1 phone?

(13) Find the area of a circle with a radius of 4cm and hence find the area of a semicircle with a radius of 4m.

(14) Donuts are 42p each of £2.15 for 6. Find the cheapest way of buying at least (a) 15 and (b) 17

(15) Draw the graph of $y = 2x + 1$ on the grid below. Complete the table below to help you.

x	-2	-1	0	1	2
y					
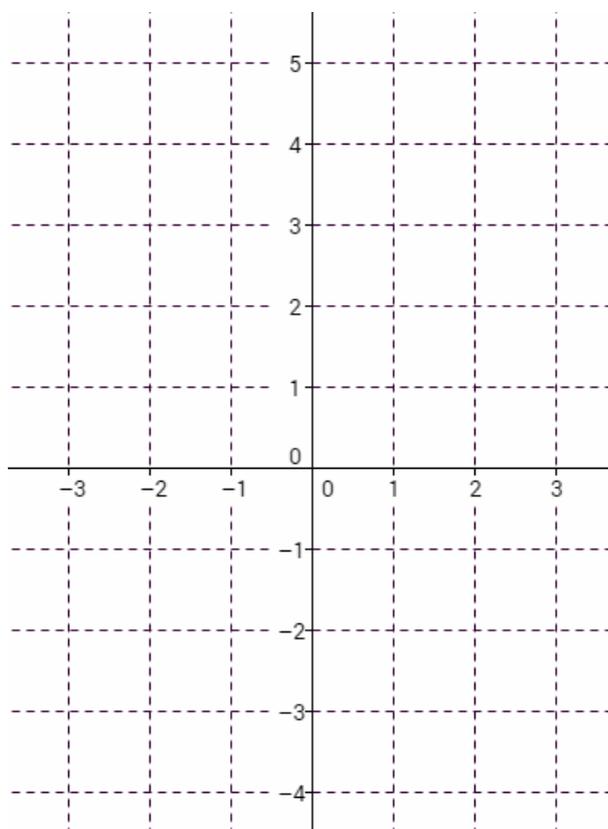
(16) Study the bus timetable below

Ludlow, Sandpits Road, Whitefriars Jct	0711	0759	0859	0959	1059
Ludlow, Clee View	0712	0800	0900	1000	1100
Ludlow, Sidney Road	0716	0804	0904	1004	1104
Ludlow, Sheet Road, Kennet Bank Jct	0717	0805	0905	1005	1105
Ludlow, Eco Park & Ride	0720	0810	0910	1010	1110
Ludlow, Tollgate	0723	0814	0914	1014	1114
Ludlow, Parys Road, opp Vashon Close Jct	0725	0816	0916	1016	1116
Ludlow, Greenacres	0729	0820	0920	1020	1120
Ludlow, Steventon New Road, Churchill Close Jct	0732	0823	0923	1023	1123

(a) Fred gets the 0800 bus from Clee View and gets off the bus at Greenacres. Given the bus has an average speed of 30 miles find the distance from Clee View to Greenacres.

(b) Sue needs to be at Tollgate for 10:08. She lives on Sandpits Road. What time will she need to catch the bus to make it on time?

(c) Show that the bus is not consistent in its average speed for each journey.

(17) Find one prime number and one square number that multiply to give a cube number.

(18) Draw a triangle with an area of $8cm^2$.

(1) Write down the next two terms in the sequence and write a rule for the sequence 1,4,9,16…. *(2 marks)*

(2) Town B is due west of Town A and 5km from Town A. Town C is 2000m due west of Town A.
(a) Find the distance from Town B to Town C. *(2 marks)*
(b) State the bearing of Town C from Town B. *(2 marks)*

(3) Bob uses the formula $C = 2W + 5$ when charging people to clean windows. C is the total cost and W is the number of windows he cleans.
(a) How much would a customer pay to have 6 windows cleaned? *(2 marks)*
(b) Fred had a bill for £35. How many windows did Fred have cleaned? *(2 marks)*
(c) Explain what the '+5' represents in the formula. *(2 marks)*

(4) Jane is cutting small gold rectangles from the large sheet of gold shown below. Each small rectangle measures 30cm by 20cm. Find the maximum number of small rectangles she can cut from the sheet? *(4 marks)*
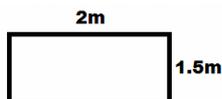
(5) Using the numbers 3, 7 and 2 and the symbols $\times, \div, +, -$ make the largest possible value. You can only use each number and each symbol once and there much be a symbol between each number e.g $3 \times 2 + 7$. *(2 marks)*

(6) Using Pythagoras theorem find the value of x and y in the triangles below. *(6 marks)*
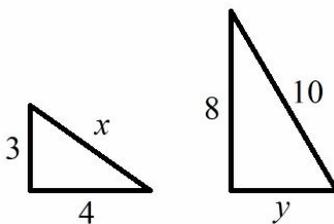
(7) Jane is making cookies using the recipe below. She has 400g of sugar, 550ml of milk, 175g flour & 6 eggs.

Ingredients for 1 cookie	
Sugar	50g
Milk	100ml
Flour	25g
Eggs	1

Find the maximum number of cookies she can make. *(4 marks)*

(8) Peter wants to buy an iPad. In the UK they are £370 including delivery and in the USA they are $520 including delivery. The exchange rate is £1 = $1.6. Should Peter buy the iPad from the UK or USA? *(3 marks)*

(9) The ratio of boys to girls in a class is 3:1. Given there are 8 girls in the class find the total number of students in the class. *(3 marks)*

(10) Write down what the shaded area shown below represents. *(3 marks)*
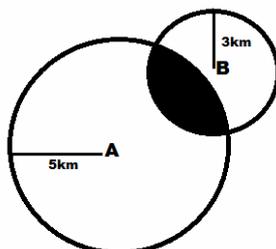
(11) Simplify the expressions: *(a)* $2x(x+1)$ (b) $3(1-3x)$ (c) $2(x-1)+3(2x+3)$ *(3 marks)*
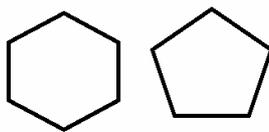
(12) Without using a calculator and showing full workings find the value of 32×27 *(3 marks)*

(13) Find the following probabilities:
(a) The probability that it rains on Tuesday is 0.45. Find the probability it doesn't rain on Tuesday. *(1 mark)*
(b) The probability that a day chosen at random from the week will start with the letter S. *(1 mark)*

(14) Study the regular shapes below:

(a) Name each shape. *(2 marks)*
(b) State the rotational order and line symmetry of each shape. *(4 marks)*
(c) Show that one of the shapes tessellates and the other doesn't. *(3 marks)*
(d) Explain what is meant by 'regular'. *(1 mark)*

(15) (a) Complete the conversion graph below *(2 marks)*

Miles	Kilometres
1	1.6
5	8
10	
	32

(b) Draw a conversion graph for miles to kilometres. 1 square = 5 miles and 1 square = 5 kilometres.
Draw the graph from 0-100 for both miles and kilometres. *(4 marks)*
(c) Use your graph to estimate how many kilometres are equal to 65 miles. *(1 mark)*
(d) Use your graph to estimate how many miles are equal to 45 kilometres. *(1 mark)*

(16) Solve the equation $2(p-7)=8$ *(2 marks)*

(17) Draw (i) an obtuse and (ii) a reflex angle stating the size of each. *(2 marks)*

(18) Find two **different** prime numbers and two **different** square numbers that add to give more than 20 but less than 30. *(3 marks)*

(19) Fred finds he has four **different** coins in his pocket. Find the difference between the maximum and minimum amount he could have in his pocket. *(3 marks)*

(20) John gets paid £6.50 an hour after all stoppages. He works 9-5 Monday to Friday without a break. He receives his weekly wages. He is given £254 for the weeks work. Show that this amount is wrong and write down what he should have been paid. *(3 marks)*

(21) Sammy reads her gas meter at the start of March and at the end of June. In March the meter reads 1250 units and in June it reads 1610 units. Sammy is charged 10p per unit for the first 300 units used and 8p per unit for any she uses after the first 300. She is given a 10% discount on her bill if she pays her bill (for March to the end of June) before August. Calculate how much she would have to pay if she paid the bill in July. *(5 marks)*

(22) The area of the square and the rectangle shown below are equal. Find the value of y giving your answer in meters. *(3 marks)*
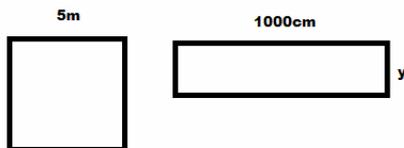
(23) (a) Find the area of a circle with a radius of 4 meters. Give your answer to 1 decimal place. *(3 marks)*
(b) Write down the area of a circle with a diameter of 8cm. Give your answer to 1 decimal place. *(2 marks)*
(c) A circular piece of wood needs painting. The diameter of the piece of wood is 8m. The cost of a tin of paint is £3.20 and covers $6m^2$. Find the cost of painting the piece of wood. *(3 marks)*

(1) Fred goes to a restaurant. To eat he can choose from Chips, Pizza, Burger or Salad. To drink he can choose from Lemonade, Water, Fanta or Milk. Write down all of the possible combinations Fred could choose from if he has 1 item to eat and 1 item to drink. *(2 marks)*

(2) Plums cost 37p each. Pete buys the maximum number he can with £5 note. How much change did he receive? *(3 marks)*

(3) The table below shows the cost of cinema tickets.

Ticket	Price
Adult	£4.80
Child	£3.60

A family ticket consists of 2 adult tickets and 2 child tickets. 15% discount is offered if you buy a family ticket. Find the cost of buying a family ticket. *(3 marks)*

(4) The cost to hire a village hall is £20 plus £14 per person who attends the event held there.
(a) Find the cost of hiring the hall if 18 people attend *(2 marks)*
(b) The bill for one event was £230. Find the number of people who attended. *(2 marks)*

(5) Sue has 36 more toys than Kate. Sue has 3 times as many toys as Kate. Find out how many toys each girl has. *(4 marks)*

(6) Here are the lengths of 12 worms in mm:
13, 25, 14, 21, 32, 41, 21, 15, 17, 28, 9, 13
(a) Draw an ordered stem and leaf diagram to show the information. *(3 marks)*
(b) Find the mode, median and mean length of the worms. *(5 marks)*
(c) Fred finds another worm which measures 5mm. What effect does this have on the (i) Mean and (ii) Range of the data? *(2 marks)*

(7) (a) Complete the frequency table for the worms in question 6 below. *(3 marks)*

Length	Frequency
$0 < l \leq 10$	
$10 < l \leq 20$	
$20 < l \leq 30$	
$30 < l \leq 40$	
$40 < l \leq 150$	

(b) Use the axis below to draw a frequency diagram to represent the lengths of the worms. *(4 marks)*
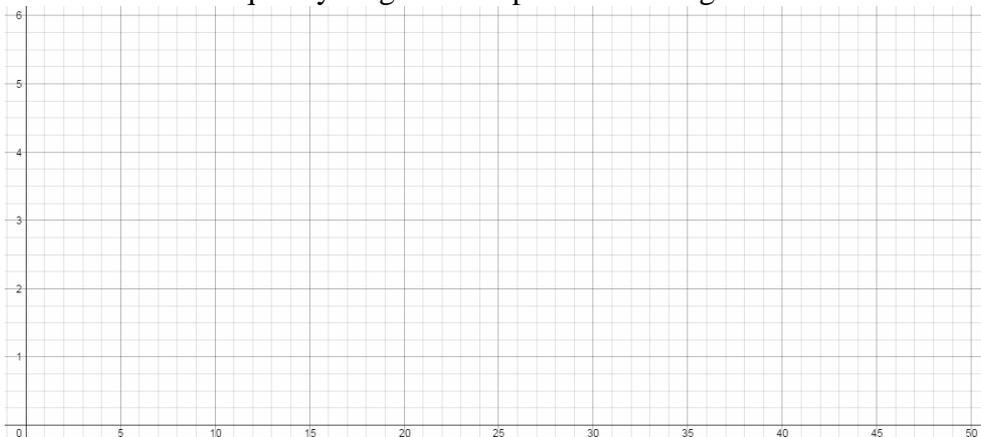
(8) Bob, Fred and Sue all have some counters. Bob has $2n$, Fred has $3n-1$ and Sue has $n+4$ counters. In total they have 39 counters. Set up and solve an equation to find how many coins they each had. *(4 marks)*

(9) Below are 3 cards. Find 3 single digit numbers such that the median of the numbers is the same as the mean. *(3 marks)*

(1) Find one prime number and one non prime number that multiply to give a square number. *(3 marks)*

(2) Without using a calculator fill out the blank -7 × ____ = 21 *(1 mark)*

(3) Fred has $3n$ coins. Gary has $n+2$ coins and Henry has $2n-1$ coins. Given they have 49 coins altogether find out how many more coins Fred has than Gary. *(4 marks)*

(4) A square has an area of $36m^2$. (a) Find the perimeter of the square. The square is to be fenced. Fencing costs £21.60 per meter. (b) Find the cost of fencing the perimeter of the square IF a 20% discount is given. *(4 marks)*

(5) n is a negative integer. Write down if the following are positive or negative: $(a)2n$, $(b)n-5$ $(c)n^2$ *(3 marks)*

(6) 41 people go to a party. 10 take Beer and 22 take wine. 5 people take both wine and beer. Find the number of people who take neither beer nor wine. *(3 marks)*

(7) Below is a stem and leaf diagram:

```
0 | 4, 6, 9
1 | 1, 1, 5, 7
2 | 3, 4, 8, 9
3 | 5, 6, 8
4 | 0
```

(a) Complete the stem and leaf diagram. *(1 mark)*
(b) Write down the mode of the data set. *(1 mark)*
(c) Find the range of the data set. *(2 marks)*
(d) Find the median of the data set.   . *(2 marks)*

(8) Solve the equation $2(3p+1)=8$ *(3 marks)*

(9) Place each number outside the square in a position such that each row **and** column equals the same amount. *(3 marks)*
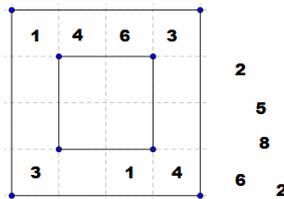

(10) The numbers 4, 3 and 9 can be arranged in 6 different ways to make different 3 digit numbers. (a) Write down the 6 possible combinations (b) Find the maximum difference between any two values out of the 6. *(4 marks)*

(11) The mean of the numbers $4, x$ and 5 is 3. Find the value of x. *(2 marks)*

(12) Bob and Fred share 20 beads.
(a) Fred says he shared the beads in a ratio of 3:4. Explain why he is wrong. *(1 mark)*
(b) Bob has 3 times as many beads as Fred. What ratio were the beads shared in? *(2 marks)*
(c) What is the lowest number of beads you would have to add to the 20 to share them in the ratio 3:4? *(2 marks)*

(13) 100 people were surveyed about eye colour and their favourite lesson. The information is shown below.
(a) Complete the two way table. *(3 marks)*

|	English	Maths	**Total**
Blue	20		35
Brown		20	
Green		10	40
Total	55		

(b) One person is chosen from the 100 at random. Find the probability it's a person with Green eyes who chose English. *(2 marks)*

(14) (a) A kite has vertices $A(2,1), B(1,3), C(2,5)$ and $D(x,y)$. Find the value of x and y & draw the kite. *(3 marks)*
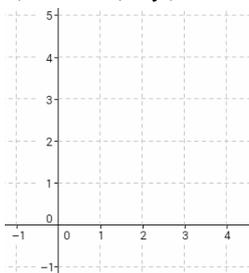
(b) Find the area of the kite. *(2 marks)*

(c) The lines AC and BD intersect at the point P. Write down the coordinates of P. *(2 marks)*

(15) Fred thinks of a number. The number is a factor of 12, a multiple of 2 and a square number. What number was Fred thinking of? *(2 marks)*

(16) Below is part of a probability scale (a) Complete the scale. *(2 marks)*

| 0.15 | 0.2 | 0.25 | 0.3 | 0.35 | 0.4 | 0.45 | 0.5 | 0.55 |
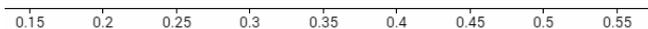
(b) The probability it rains on any given day is 0.65. Mark on the line the probability that it doesn't rain on any given day. *(2 marks)*

(17) Jane earns £14000 a year. She has a tax free allowance of £9200 and pays 20% tax on her taxable earning. Find out how much tax she pays in a year. *(2 marks)*

(18) Bill needs to hire a taxi for a 120 miles journey.
Company A charge a £50 fixed rate and £2 per mile
Company B charge £3.20 a mile and have no fixed charge.
Advise Bill on which company he should use for the journey. *(3 marks)*

(19)An **open topped** box is shown below.
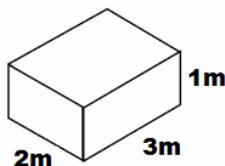
(a) Find the volume of the box. *(2 marks)*

(b) Find the surface area of the box. *(3 marks)*

(c) Paint costs £2.10 a tin and each tin covers $1.5m^2$. Find the cost of painting the box. *(3 marks)*

(20) (a) Find the mode, median, mean and range of the following numbers. 5, 6, 4, 3, 7, 10, 0, 5, 8, 2 *(4 marks)*

(b) The number 11 is added to the data set. Explain how it will change the mode, median, mean and range of the number. *(3 marks)*

(21) Bob has double the amount of sweets as Reg. Bob has 24 more sweets than Reg. How many sweets does Reg have? *(3 marks)*

(22) Without using a calculator complete the table below. *(3 marks)*

| $9 \times 8 = 72$ | $90 \times 80 =$ | $9 \times 0.8 =$ | $0.9 \times 0.8 =$ |

(23) Write 4/5 as a decimal. *(1 mark)*

(24) Draw a rectangle with an area of $12cm^2$ and find its perimeter. *(3 marks)*

(25) (a) The spinner below is spun once. Find the probability the arrow lands on the number 4. *(1 mark)*
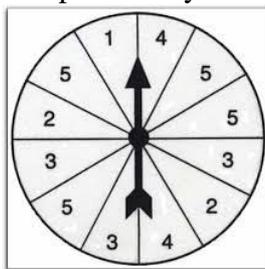
(b) The spinner is spun twice and the two numbers are multiplied. Jim has a go and scores the largest possible score. Fred has a go and scores the lowest possible score. Find the difference between what Fred and Jim scored. *(3 marks)*

(c) The same rules apply as they did in question (b). Bob scores a prime number when his two numbers are multiplied. Write down what Bob could have scored on spin 1 and spin 2. *(2 marks)*

(d) Which combinations will give square numbers if the rules still apply from part (b)? *(3 marks)*

(26) Find the area of a circle with a radius of 7cm. *(2 marks)*

(27) From the list of numbers below pick (a) A factor of 6 (b) A multiple of 3 (c) A cube number (d) A prime number and (e) a non integer. *(5 marks)*

4, ½, 7, 9, 27, 5, 3, 16, 47, 13

(1) (a) Show the difference between the volume & the surface area of the closed top cuboid shown below is 34. *(5 marks)*

(b) Write down the units the volume is measured in and the units the surface area is measured in. *(2 marks)*

(c) A tap can fill the cuboid shaped tank when the lid is taken off at a rate of $12cm^3$ per second. Find how long it will take to fill the tank. *(3 marks)*
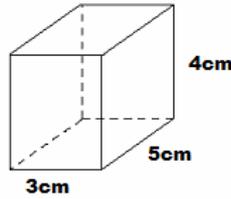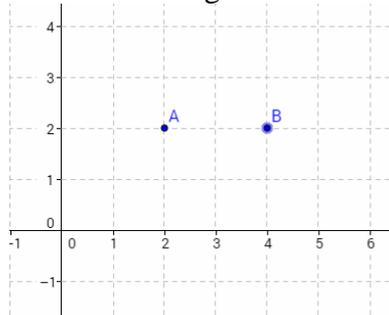

(2) (a) Draw a chord and a tangent on the circle below. *(2 marks)*

(b) Show that the area of the circle is $79cm^2$ to the nearest cm. *(2 marks)*
(c) Find the circumference of the circle. *(2 marks)*

(3) In the diagram below B is the midpoint of the line segment AC.

(a) Write down the coordinates of C. *(2 marks)*
(b) The triangle ACD is an isosceles triangle. Write down the possible coordinates of D. *(2 marks)*
(c) Find the area of the triangle ACD from your answer in part (b). *(2 marks)*
(d) Write down (i) The line symmetry of triangle ACD and (ii) the rotational order of symmetry. *(2 marks)*

(4) Fred thinks of a prime number. If he rounds it to the nearest 10 the answer will be 20. If he adds 3 to it the number will be a multiple of 5. Find the number Fred was thinking about. *(2 marks)*

(5)The angles a,b,c and d are shown below.
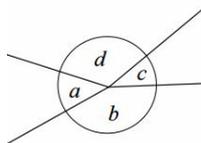
(a) Write down which 2 angles are obtuse angles. *(2 marks)*
(b) Given d and b are both over 100° find the maximum value of a + c. *(3 marks)*
(c) Explain using the diagram why the angles b + c sum to give more than 180º. *(2 marks)*
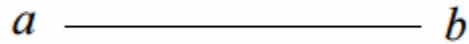(d) Given angle a is 59º find the value of b + c + d. *(2 marks)*

(6) (a) Circle any two congruent shapes below. *(2 marks)*
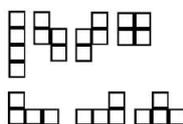
(b) Show that the perimeters of the shapes are not all the same. *(2 marks)*

(7) (a) Draw a line parallel and a line perpendicular to the line *ab* below. *(2 marks)*

$$a \text{————————} b$$

(b) Draw a point *c* such that the triangle *abc* is (i) Isosceles (ii) Right angled and (iii) Scalene. *(3 marks)*

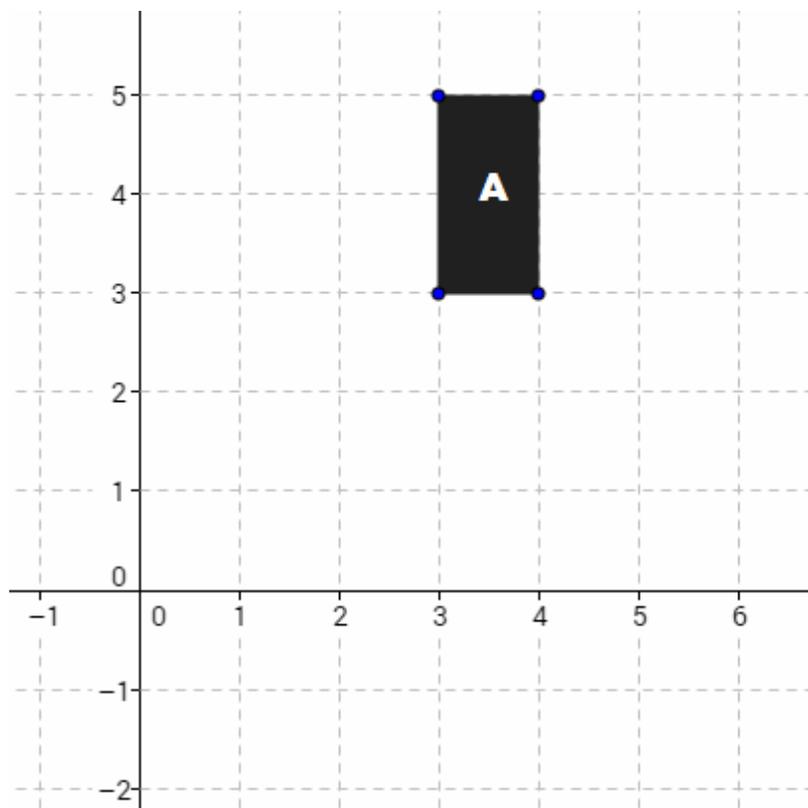(i) $a \text{————————} b$ (ii) $a \text{————————} b$ (iii) $a \text{————————} b$

(8) Which is larger and by how much? $\dfrac{4}{5}$ *of* 80 **or** 75% *of* 75. *(3 marks)*

(9) (a) Reflect the shape A below (i) in the line $x = 2$ and (ii) in the line $y = 3$. (Label the shapes B and C respectively). *(2 marks)*

(b) Translate the shape A by the vector $\begin{pmatrix} 2 \\ -1 \end{pmatrix}$ and label the shape D. *(2 marks)*

(1) Draw a quadrilateral and state (i) The sum of its interior angles (ii) Its rotational order of symmetry and (iii) The line symmetry of the shape. *(4 marks)*

(2) (a) Convert 300ml into litres. *(1 mark)*

(b) Fred has a number of glasses that can hold 300ml of water each. He fills 14 from a 6lt tank. Find out how much water is left in the tank giving your answer in ml. *(3 marks)*

(3) 5kg of apples cost £2.75. Find the change Bob would get from £2 if he bought 3kg of apples. *(3 marks)*

(4) The speedometer below measures speed from 0mph to 150mph in staged increments.

(a) Mark on the speedometer the value of each increment shown. *(3 marks)*

(b) Sue enters a 40mph zone. How much does she need to reduce her speed by if the diagram below is correct? *(2 marks)*

(5) John picks 1 prime number (x) and one non prime number (y) such that the value of $\sqrt{x+y}$ is a multiple of 2. Find a possible value for x and a possible value for y. *(3 marks)*

(6) Find the size of each angle in the scalene triangle below. *(4 marks)*
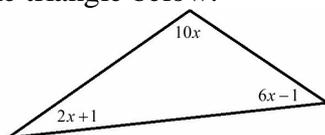
(7) (a) Pete buys the same newspaper every day and pays with one 50p coin. He is given 3 **identical** coins in his change. What is the lowest price the newspaper could be? *(2 marks)*

(b) One day Peter sends his wife to buy the newspaper. She pays with a £1 coin and receives 4 **different** coins in her change. Pete thinks the price of the newspaper may have reduced. Could he be right? (You MUST show full workings to gain the marks). *(3 marks)*

(8) (a) Study the map below of towns A, B, C and D and complete the sentence.

"Town B is due_____ of A, due_____ of C and due_____ _____ of D" *(3 marks)*

(b) State the bearing of C from B. *(1 mark)*

(c) Given 1cm = 1km show the locus of points that are more than 2km from C. *(2 marks)*

(9) Jim and Tim each run their own taxi business. The cost to use Jim and Tim is shown below in the graph. The miles travelled are on the horizontal axis and the cost of the journey on the vertical axis.
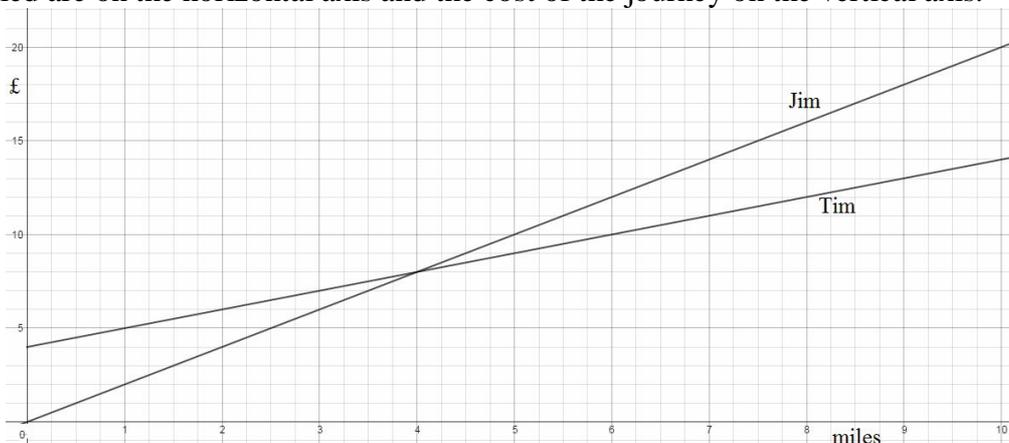
(a) What is Tim's fixed charge? *(1 mark)*

(b) How much does Jim charge per mile? *(2 marks)*

(c) After how many miles does Tim become cheaper to use than Jim? *(1 mark)*

(d) How much would it cost to travel 9 miles using (i) Jim and (ii) Tim? *(2 marks)*

(e) Write a formula for the cost of using each taxi business using C (cost) and m (miles travelled). *(4 marks)*

(1) Bob has 8 counters in a bag. Some are black counters and some are white counters.

(a) Bob adds 2 white counters to the bag. The probability of now getting a black counter is 0.7. How many white counters were there in the bag originally? *(3 marks)*

(b) What is the least number of black counters would he have to remove from the bag **with 10 counters in** to give the ratio of black to white counters of 2:1? *(3 marks)*

(2) Given ¼ $= 0.25$ write down the value of (a) 1/8 and (b) 5/8 as a decimal. *(2 marks)*

(3) Given the volume of the closed top cuboid below is $72cm^3$:

(a) Find the value of x. *(3 marks)*

(b) Find the surface area of the cuboid. *(4 marks)*
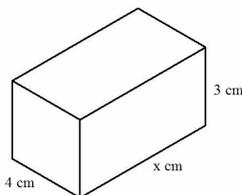
(c) Write down the number of (i) faces (ii) edges and (iii) vertices the cuboid has. *(3 marks)*

(4) Find the value of x that makes the following calculation true: $4 \times \sqrt{x} = 20$ *(3 marks)*

(5) Bob has a sink that is half full. He fills it to the top with 2400ml. Write down the capacity of the sink in litres. *(2 marks)*

(6) Solve the following equation: $0.5p - 1 = 4$ *(2 marks)*

(7) Draw a shape with line symmetry of 3 and rotational order of 3. *(2 marks)*

(8) (a) Draw a shape that is congruent to the one below. *(1 mark)*

(b) By drawing at least 5 congruent shapes to the one above show that the shape tessellates. *(2 marks)*

(c) Find the perimeter of the shape. *(1 marks)*

(d) Draw two additional blocks on the shape in order to increase its perimeter by 4 units. *(2 marks)*

(9) Find the size of angle x and angle y in the diagram below. *(4 marks)*
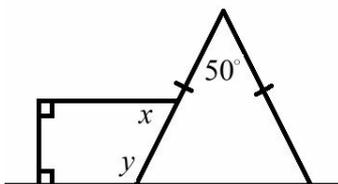
(10) Factorise: (i) $3x - 12$ (ii) $6x + 9$ (iii) $5 - 10x^2$ *(3 marks)*

(11) Find the value of x in the triangle below: *(3 marks)*
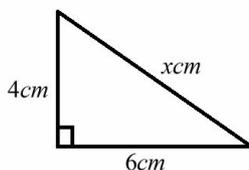
(12) John can buy buns in packs of 6 and burgers in packs of 8. What is the lowest amount he would need to buy of each to ensure there is exactly one burger for each bun? *(3 marks)*

(13) Fred can buy two types of sweet. Sweet A costs 23p and Sweet B costs 32p. Fred buys some of each. His bill comes to £2.29. Explain how you know he bought and odd number of Sweet A. *(3 marks)*

(14)(a) Write down an estimate for the area of the shape below. *(2 marks)*
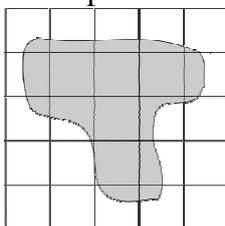
(b) Write down an estimate for the percentage of the large square that the shape covers. *(3 marks)*

(15) A bus starts its journey with 50% men on board and 50% women. At the first stop only women get on the bus. The ratio of women to men is now 2:1. Write down the possible number of men and possible number of women that started on the bus and the number of each after the first stop. *(3 marks)*

(16) Below is a Venn Diagram showing the drinks people took to a party
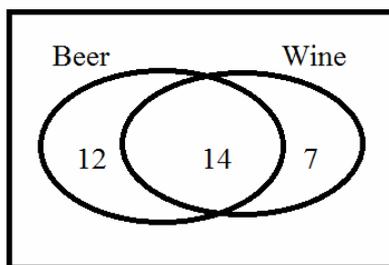
(a) How many people took Wine? *(1 mark)*
(b) How many people took Beer but not wine? *(1 mark)*
(c) Given twice the number who took beer didn't take anything, complete the Venn Diagram. *(2 marks)*
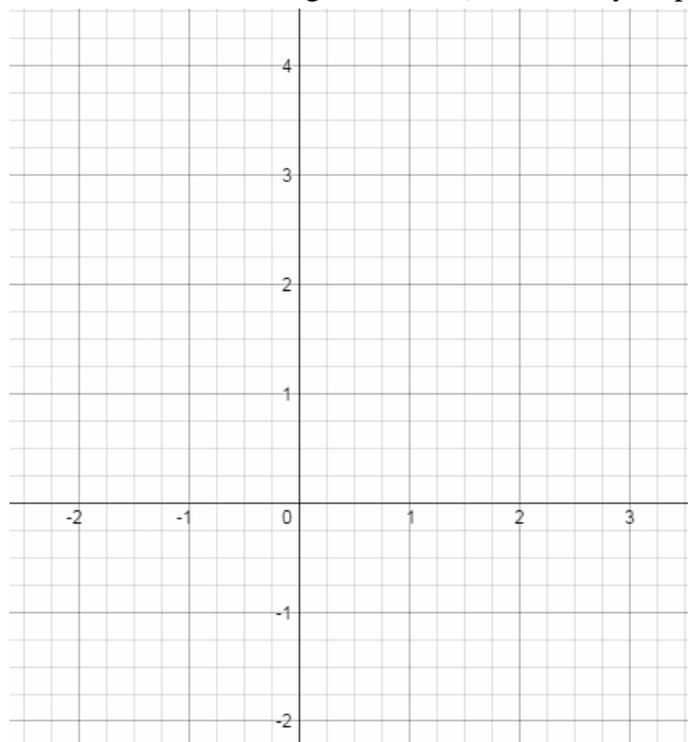(d) One person is chosen at random. Find the probability they took only wine to the party. *(2 marks)*

(17) Complete the table below for $y = x^2 + 2x$ *(4 marks)*

x	-1	0	1	2
y				

(18) Bob goes on holiday for 13740 minutes. How many weeks, days, hours and minutes is this? *(4 marks)*

(19) Draw the graph of $y = x + 1$ for $-2 \le x \le 3$ on the grid below. (A table may help). *(4 marks)*

(20) Bob is counting his money at home. He makes a frequency chart with the result.

Note	Frequency
£5	9
£10	3
£20	12

(a) How much money does he have in total? *(2 marks)*
(b) He chooses a note at random. Find the probability that it's a £10 note. *(2 marks)*
(c) How many more £5 notes would he need to match the total value of his £20 notes? *(2 marks)*
(d) How many more £20 notes would Bob need to have for the notes to be in the ratio 3:1:5 (£5 to £10 t0 £20)? *(2 marks)*

(21) Write down 3 consecutive numbers that sum to give more than 100 but less than 110. *(3 marks)*

(1) Fred spins two spinners, A and B, and **multiplies** the score shown on each spinner. Some of the information and scores are shown in the table below.

Spinner 1

|	×	1	3		5
Spinner 2	2				
			9		
	6			24	
	7	7			

(a) Complete **all** of the missing values in the table above. *(3 marks)*
(b) One score is chosen at random. Find the probability the score is a prime number. *(2 marks)*
(c) Find the modal score. *(1 mark)*

(2) Pete uses the following rule: "Double the number and then adds 3".
(a) Pete starts with the number 4. What number will he get if he applies the rule? *(1 mark)*
(b) Pete applies the rule and the number he finishes with 33. What number did he start with? *(2 marks)*

(3) Sue has two tanks in the shape of cuboids as shown below. She can fill tank A up from a tap that flows out at $10cm^3$ per second and she can fill tank B up from a tap that flows out at $3cm^3$ per second. Show that tank B will fill from empty 10 seconds before tank A if she starts the taps at the same time. *(5 marks)*

A
4cm
6cm
5cm

B
2cm
1cm
3cm
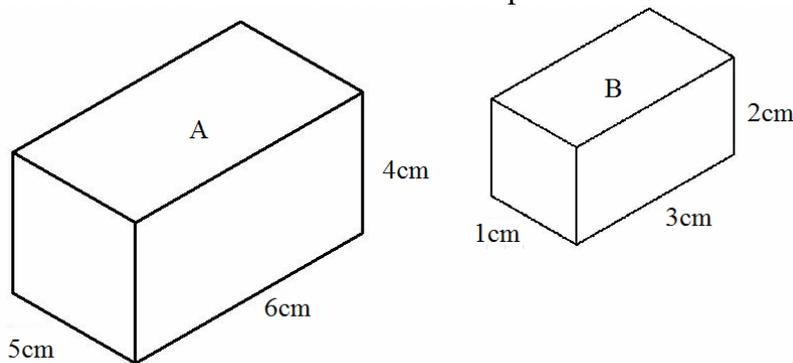
(4) Solve the equation $8 = 2 + 3y$ *(2 marks)*
(5) Fred has the following letters he cut out of a newspaper.

A   G   H   Y   T   O
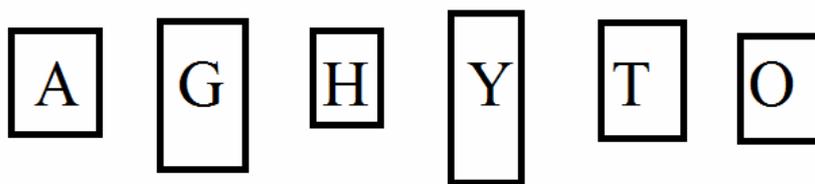
(a) He picks a letter at random. What is the probability it's a vowel? *(1 mark)*
(b) The first letter he picked wasn't a vowel so he throws it away. What is the probability he now chooses a vowel with his second pick? *(2 marks)*
(c) Given A = 2, Y = 3 and T = 5, write down the value of A×Y+T. *(2 marks)*

(6) Find the missing number that makes the following calculation true: $4 + \underline{} \times 2 = 10$ *(2 marks)*

(7) Study the list of numbers below:

4, 13, 5, 7, 12, 9, 34

John picks the number in the list that is both a prime number **and** a factor of 20.
Sue picks the number in the list that is a multiple of both 2 **and** 3.
Find the difference between the two numbers they chose. You must show your workings. *(4 marks)*

(8) Bob receives an offer from his gas company. *"20p per unit used and 10% discount off your bill."*
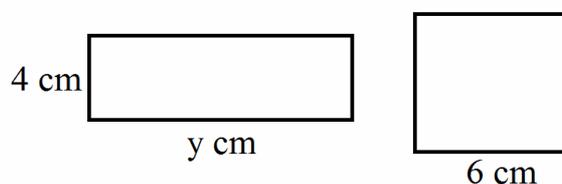Bob uses 120 units of gas. Find the cost of his bill after the discount. *(4 marks)*

(9) (a) Fill out the table for $y = 2x + 1$ for $-2 \leq x \leq 2$ in the table below. *(2 marks)*

x	-2	-1	0	1	2
y			1		

(b) Plot the graph of $y = 2x + 1$ for $-2 \leq x \leq 2$ on the axis below. *(2 marks)*
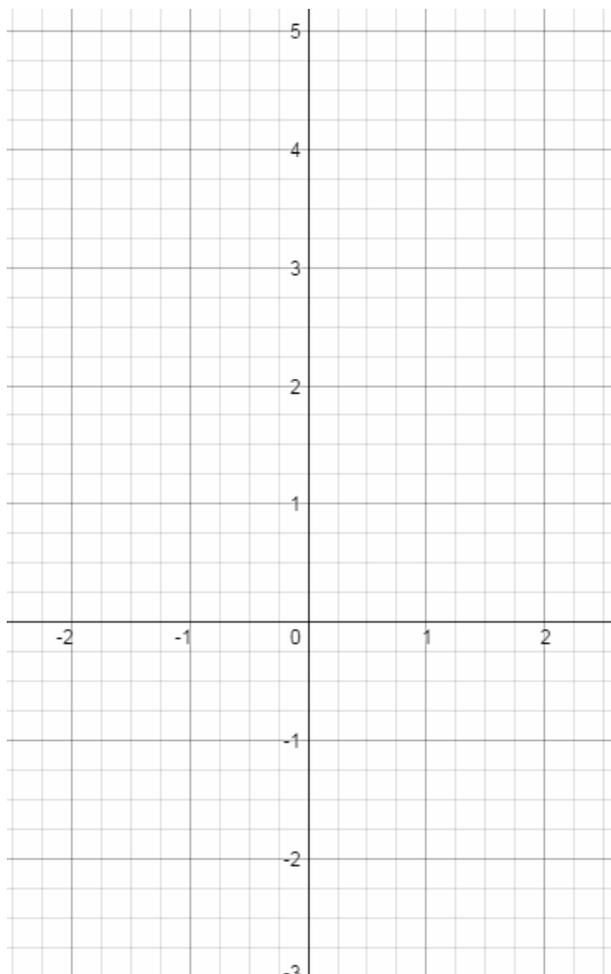
(10) The area of the square and the rectangle pictured below are the same.

4 cm

y cm

6 cm

(a) Find the value of y. *(3 marks)*
(b) Find the perimeter of the square. *(2 marks)*

(12) Show there are exactly 3 prime numbers that satisfy the inequality $2 \leq x < 7$. *(2 marks)*

(13) An isosceles triangle has one angle of 35 degrees. State the possible values of the other two angles and sketch the triangles below. *(3 marks)*

(14) (a) The mean of the following numbers is 5, find the value of n: $5, 3, 7, n, 9, 0, 10$ *(3 marks)*
(b) Show that the range of the data set us twice the median of the data set. *(2 marks)*

(1) Write down a pair of numbers that have a HCF of 4. *(2 marks)*

(2) There are 10counters in a bag. The counters are either black or white. Bob says the chance of pulling out a white is 0.24. Explain why he wrong and write down all the possible probabilities of pulling a white counter from the bag. *(4 marks)*

(3) Given the surface area of the **closed top** cuboid below is $94cm^2$:

(a) Find the value of x. *(4 marks)*

(b) Find the volume of the cuboid. *(2 marks)*
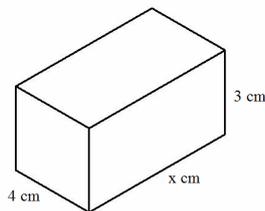
(c) Jim says the cuboid has more faces than edges. Is he right? You must show your workings. *(3 marks)*

(4) Fred buys 4 identical bars chocolate. He pays with a £1 coin. He receives 3 coins in his change. Find out the maximum each bar could have cost. (The coins can be the same). *(3 marks)*

(5) Jane has driven 720 miles and used ¾ of a tank of petrol. How many miles would a full tank do? *(2 marks)*

(6) Round 234.27 to (i) 1 decimal place (ii) two significant figures and (iii) the nearest integer. *(3 marks)*

(7) Complete the table for $y = 3x - 1$ *(2 marks)*

x	-3	-2	-1	0	1	2	3
y							

(8) (a) The fair 6 sectioned spinner (numbered 1-6) is spun once. Find the probability of scoring a prime number OR a multiple of 2. *(1 marks)*

(b) The spinner is spun 300 times. How many times would you expect to score a 4? *(2 marks)*

(9) (a) State what the arrows on the 2 horizontal lines show in the diagram below. *(1 marks)*

(b) Find the size of angle x and angle y in the diagram below. *(4 marks)*
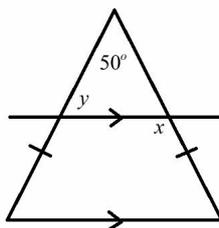
(10) Factorise: (i) $5x - 15$ (ii) $4x + 6$ (iii) $2 - 8x^3$ *(3 marks)*

(11) At a school there are 180 pupils. 120 do Maths and 110 do English. Given only 20 do neither Maths or English find how many students do BOTH maths and English. *(3 marks)*

(12) Find the area and circumference of a circle with a radius of 6cm. *(4 marks)*

(13) Fred buys a number of chews and chocolates. Chews are 8p each and chocolates are 6p each. He fills a bag and the shop keeper asks him for £2.83. Should Fred question this price? *(3 marks)*

(14) (a) Write 0.4 as (i) a fraction and (ii) a percentage. *(2 marks)*

(b) Find 0.4 of $20. *(2 marks)*

(15) The ratio of men to women to children at a party is 5:4:2. Given there are 14 children at the party find out how many more men there are than women at the party. *(3 marks)*

(16) Solve the equation $8 = 3x - 1$. *(2 marks)*

(17) Complete the table below for $y = 2x^2 + 1$ *(4 marks)*

x	-1	0	1	2
y				

(18) Given 1 mile = 1.6km find out which is further: (a) 31 miles or (b) 49km (Show your workings) *(4 marks)*

(19) (a) Fred only gets paid for every full hour he completes. He started his shift at 4:43 am and finished at 13:18. Given he is paid £9.12 an hour work out what he paid for his shift. *(3 marks)*

(b) Fred's wife earns £14000 a year and is taxed on earnings over £9200. She is taxed at 15% on these earnings. Find out how much tax she pays each year. *(3 marks)*

(1) Write down a pair of numbers that have a LCM of 12. *(2 marks)*

(2) Trevor buys 2 bars of chocolate for 49p each and 3 identical bags of crisps. He pays with a £5 note and gets £2.34 change. How much did each bag of crisps cost? *(3 marks)*

(3) (a) Translate shape A below by the vector $\begin{pmatrix} 1 \\ -2 \end{pmatrix}$ and label the shape B. *(2 marks)*

(b) Reflect shape A below in the line $y = 1$ and label it shape C. *(2 marks)*

(c) Rotate shape A below 90° clockwise about the origin and label it D. *(2 marks)*

(d) State the single transformation that maps shape A to shape E. *(2 marks)*
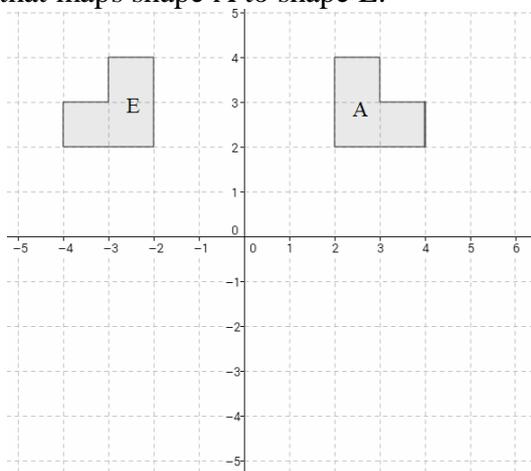
(4) Below is the calendar for **June** 2015.

(a) Find the date of the 3rd Thursday in July 2015. *(2 marks)*

(b) Bob went on holiday for 3 weeks and returned on the 26th of June. What day did he leave? *(1 mark)*

(c) Write down the number of Wednesdays in July 2015. *(2 marks)*

(5) Cakes cost 80p each or £3 for 5. Find the maximum number of cakes you can buy with £10.75. *(3 marks)*

(6) Using the conversion £1 = $1.6 find the cost in £s of an iPad that costs $337 giving your answer to the nearest penny. *(2 marks)*

(7) Factorise the following: (i) $10x + 15$ (ii) $4 - 6x$ (iii) $3p^2 + 6q$ *(4 marks)*

(8) Complete the table below for $x + y = 5$ *(2 marks)*

x	-2	-1	0	1	2	3
y						

(9) (a) Draw 2 congruent rectangles. *(2 marks)*

(b) State the line symmetry and rotational symmetry of the rectangles. *(2 marks)*

(c) Sketch a rectangle with an area of 16cm². You must state the side lengths. *(2 marks)*

(10) Solve the equation $6(p + 2) = 18$ *(2 marks)*

(11) Tom is n years old. Fred is twice Tom's age and Sue is 3 years younger than Tom.

(a) Given their combined age is 77 set up and solve an equation to find the value of n. *(4 marks)*

(b) How old will Tom be in 8 years time? *(2 marks)*

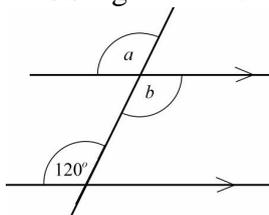(12) Find the value of p in the diagram below. *(2 marks)*
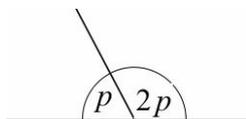
(13) Find the nth term of the following sequence: 5, 8, 11, 14…… *(2 marks)*

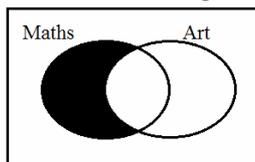(14) Fill out the table for $y = x^2 + 2x$ below. *(3 marks)*

x	-2	-1	0	1	2	3
y						

(15) Find the size of angle a and angle b. You MUST give a reason for your answers. *(3 marks)*

(16) At a school some students study Art and some study Maths.

(a) Explain what the black section represents in the Venn Diagram below. *(1 mark)*

(b) There were 100 students at the school. 30 did neither maths nor art. 40 did Maths and 50 did Art. Find the number who did both Maths and Art. *(3 marks)*

(17) Without using a calculator state which of these numbers are integers: 2^3, $\sqrt{8}$, 1^5, $\sqrt{25}$, 1.2^2 *(2 marks)*

(18) Paul has a biased spinner. The probability of him landing on any of the 4 sections is given below.

(a) Find the value of x *(2 marks)*

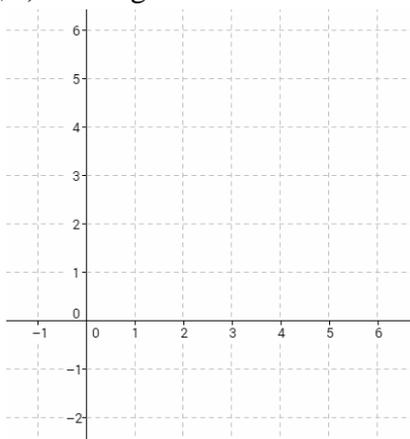| Section	Red	Blue	Green	Yellow
Probability	0.2	x	0.35	0.15

(b) Paul spins the spinner 200 times. How many times would you expect it to NOT land on Blue? *(3 marks)*

(19) Find the region that is more than 3cm from A but less than 2cm from B. *(3 marks)*

A.   .B

(20) (a) Mark the points $P(2, 2)$ and $Q(6, 4)$ on the grid below. *(2 marks)*

(b) Write down the coordinates of the midpoint of the line PQ. *(2 marks)*

(c) Draw a line perpendicular to the line PQ that passes through the midpoint of the line PQ. *(2 marks)*

(d) The point R is the point such that the triangle PRQ is a right angles triangle. Mark on the grid one point where R could be. *(2 marks)*
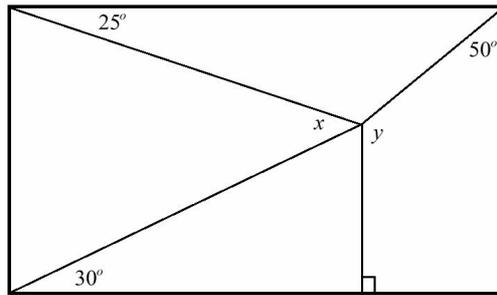
(21) Complete the table below. *(5 marks)*

A1= $(2 \times C2)=$	B1= $\sqrt{81}=$	C1= $5(2+1)=$	D1= $14 \times 0=$	E1= $\sqrt{25}=$
A2= $5^3=$	B2= $2^3=$	C2= $(3 \times B2)=$	D2= $1-(-9)=$	E2= $6^2=$
A3= $0.5^2=$	B3= $2+3 \times 2=$	C3= $(2 \times C1)=$	D3= $(0 \times B3)=$	E3= $(0.5 \times B2)=$

(1) Solve the equation: $10 = 4p + 2$ *(3 marks)*

(2) Find the value of x and the value of y in the rectangle below. *(5 marks)*

(3) Sue has n coins. Fred has 3 times more coins than Sue and Jim has 3 more coins than Sue. Given they have 83 coins in total find out how many coins Jim has. *(5 marks)*
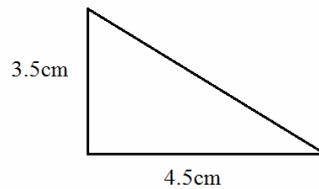
(4) Add the first 4 prime numbers together. *(2 marks)*

(5) Find the area of the triangle below and round your answer to (i) 2 decimal places and (ii) 2 significant figures. *(4 marks)*
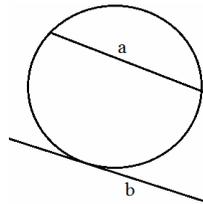
(6) Sue receives a bill for 3 packs of biscuits each costing £1.37 and 5 cakes each costing the same amount. The bill is £16.26. Find the cost of each cake. *(3 marks)*

(7) Name the circle parts labelled below: a_____ b_____ *(2 marks)*

(8) John buys a car with 10,426 miles on the clock. After 6 months the car has done 14,312 miles. The car travels 9 miles for every litre of petrol it uses. Find out how many litres of petrol John put in the car. Give your answer to the nearest litre. *(3 marks)*

(9) The Venn Diagram below shows information about students at a college who take Maths and Science.

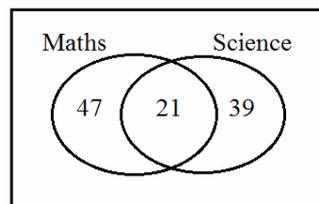(a) Given there are 140 pupils at the college, complete the Venn Diagram. *(2 marks)*

(b) One person is chosen at random. Find the probability that person Does Science but not Maths. *(2 marks)*

(c) State how many more people do Maths only than both Maths and Science. *(2 marks)*

(10) Here is a list of numbers: 1, 5, 3, 17, 8, 4, 21, 17, 0.5, 18, 7

(a) Write down all the prime numbers in the list. *(1 mark)*

(b) Write down all the square numbers in the list. *(1 mark)*

(c) Write down all the cube numbers in the list. *(1 mark)*

(d) Write down the non integer in the list. *(1 mark)*

(11) Mike has a rectangular field. The side lengths are 80m by 60m. He needs to fence the perimeter of the field. Fencing costs £2.10 per meter but if he buys the fencing in April he will save 10%. Find the cost of buying enough fencing for the job if he buys it in April. *(5 marks)*

(1) Gary joins the *'Monday Chess Club'* which meets every Monday. It costs £7.50 to play each week. What is the maximum amount of money he would have to set aside to play every week for **any** given month? *(3 marks)*

(2) Sue designs a game. In the game there are four cards. The probability of picking a prime number is ½ . The probability of picking a square number is 0.25. There is a one in four chance of picking a cube number. Sue can't think of any numbers to use. Fill the cards out below to help her pick the numbers for her game. *(4 marks)*
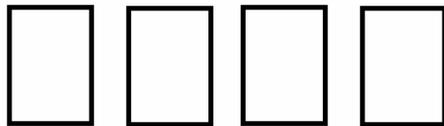
(3) Bob is tiling his kitchen floor. The kitchen measures 6m by 16m. He uses the tiles below to tile the floor.
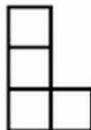
(a) Find the number of tiles he needs to complete the job. *(Each **square** on the tile is 1 meter long)* *(3 marks)*

(b) Tiles are £18 each but you get 1/3 off if you buy more than 10. Find the cost of tiling the floor. *(3 marks)*

(4) Town A and Town B are shown below.

.Town B
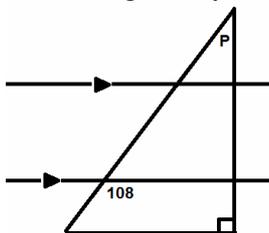
. Town A

(a) Find the bearing of Town A **from** Town B. *(2 marks)*

(b) Given 0.5cm = 1.5km, find the distance from Town A to Town B to the nearest 100m. *(2 marks)*

(5) Fill out the table below for $y = 2x^2 + 3x$ *(3 marks)*

x	-3	-2	-1	0	1	2	3
y							

(6) Find the size of angle P in the diagram below stating how you found your answer. *(3 marks)*

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(7) (a) State the rotational order symmetry of the shape below. *(1 mark)*

(b) Add 2 more squares to the shape below to give the shape a line symmetry of 2. *(1 mark)*

(c) The shape above is a net of an open top cube shaped tank. The side lengths are 4m. Water is to be poured into the tank at a rate of $2m^3$ per second. Find how long it will take to fill the tank from empty. *(4 marks)*

(8) Fred uses the formula $C = 10 + 4M$ to charge his taxi customers. C is the cost in £ and M is the number of miles travelled. The miles travelled are rounded up to the nearest whole mile. Bob uses Fred's taxi and receives a bill of £61. Explain why the bill is incorrect and estimate how many miles Bob's journey was. *(3 marks)*

(9) At a school 0.25 of the people are boys, ½ are girls, 15% are TA's and the rest are teachers. Given there are 20 teachers, find how many more girls there are than boys at the school. *(4 marks)*

(10) Using the exchange rates £1 = $1.5 and $1 = €1.2:

(a) Find the out the price in €of an iPad costing £320 *(2 marks)*

(b) Find the cost in £ of buying an iPhone costing €560 giving your answer to the nearest penny. *(2 marks)*

(1) At a youth club there are 3 age categories. They are *Ten and under*, *11 to 15 years old* and *over 15's*. 2/3 of the members are in the *Ten and under* section, 1/6 are in the *11 to 15 years old* and the rest are in the *over 15's*. What fraction of the members are in the *over 15's* section? *(3 marks)*

(2) Solve the equations: (a) $3x - 1 = x + 5$ (b) $\dfrac{x-3}{6} = 3$ *(4 marks)*

(3) Simplify the following: (a) $p^5 \times p^4$ (b) $p^7 \div p^{-3}$ (c) $m^7\left(m^3 - 4\right)$ *(3 marks)*

(4) Plot the graph of $y = 2x + 1$ for $-2 \le x \le 2$ (Use a table of values to help you) *(3 marks)*
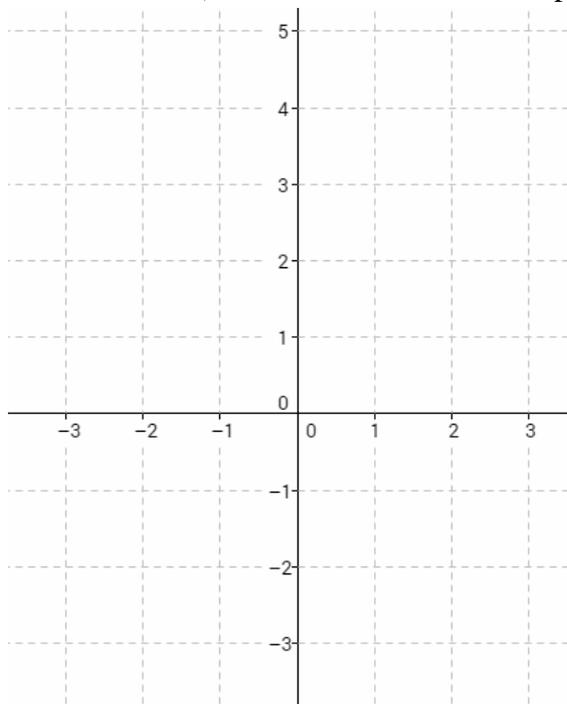
(5) Fred thinks of 3 numbers. The first number is a single digit prime number. The second number is a single digit cube number. The third number is a double digit square number. He adds all 3 numbers together. Show that he could make the number 29 by adding the three numbers he is thinking of. *(4 marks)*

(6) A biased spinner has four sections. The probability of landing on each section is given below in the table.

Colour	Blue	Red	Green	Yellow
Probability	0.2	0.1	x	x

(a) Find the value of x *(2 marks)*
(b) The spinner is spun 200 times. Find the number of times you would expect it to land on red. *(2 marks)*
(7) Find 3 consecutive single digit integers that sum to more than 10 but less than 15. *(2 marks)*
(8) Write down the set of integers that satisfy $-3 \le x < 5$ *(2 marks)*
(9) Write down the reciprocal of 4. *(1 mark)*
(10) Simplify $2(x + 3y) - 4x + y$ *(2 marks)*

(11) Without using a calculator find the value of (a) $(-3) \times 6$ (b) $(-30) \div (-6)$ (c) $-4 - (-6)$ *(3 marks)*

(12) There are 6 counters in a bag. The counters are either black counters or white counters. The ratio of black to white is 2:1. One additional black counter is now added to the bag. Bob takes a counter at random. Find the probability that he picks a black counter. *(3 marks)*
(13) Place the 4 numbers shown below in the boxes to make a valid calculation. *(3 marks)*

☐ **+** ☐ **X** ☐ **=** ☐

20   4   8   2

(14) An oil tank is ¼ full. The tank still has room for an extra 480 litres. Find the capacity of the tank. *(3 marks)*

(1) Without using a calculator, show that 5/8 is less than 0.65. *(2 marks)*

(2) Find 2 square numbers where one of the numbers is the HCF of the 2 numbers and the other number is the LCM of the 2 numbers. *(3 marks)*

(3) There are less than 10 counters in a bag. If Paul adds one more counter to the bag the probability of picking a blue counter is one half. What is the maximum number of blue counters there could have been in the bag before Paul added the new counter. *(3 marks)*

(4) Bob designs a game with two spinners. Spinner #1 has the numbers 2, 3, 16 and 17 on and Spinner #2 has the numbers 1, 8, 9 and 21 on. Bob spins the two spinners. The numbers obtained are paired and written down. The outcomes are shown below.

	2	3	16	17
1	1,2	1,3		
8	8,2			
9	9,2			
21				

(a) Complete the table. *(3 marks)*
(b) Find the probability of obtaining 2 square numbers. *(2 marks)*
(c) Find the probability of obtaining 2 prime numbers. *(2 marks)*
(d) Find the probability of obtaining 2 cube numbers. *(2 marks)*
(e) Find the probability of obtaining 1 square number and 1 cube number. *(2 marks)*
Bob decides to alter the game and change **one** of the numbers on **one** the spinners.
(f) Write the numbers that should now appear on each spinner below such that the probability of obtaining 2 prime numbers is 3/16. *(You are only changing one number from the previous 8 original numbers)* *(3 marks)*

Spinner 1   Spinner 2
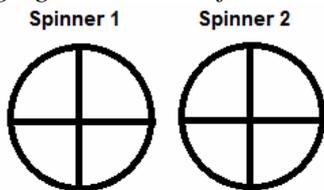
(5) Find the value of n for each of the following: (a) $p^n \div p^2 = p^3$ (b) $p^7 \times p^n = p^{21}$ *(2 marks)*

(6) Show that the length of each diagonal of the rectangle below is 15.8cm correct to 1 decimal place. *(3 marks)*

9cm

13cm
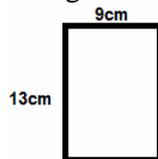
(7) Jackie says there are less than ¼ of a million seconds in 3 days. Show that she is wrong. *(3 marks)*

(8) (a) Write down an algebraic expression for "1 less than three times x" *(1 marks)*

(b) Fred is x years old. Sue is 2 years older than Fred and Bob is 1 year less than 3 times Fred's age. Given their combined age is 36 set up and solve an equation to find how old Sue is. *(3 marks)*

(9) Complete the table below for $y = x^2 + 2x - 1$ *(3 marks)*

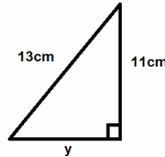| x	-2	-1	0	1	2	3
y						

(10) Peter has 5 piles of coins laid out in a row. Each pile has twice as many coins as the pile before it. What is the minimum number of coins Peter can have in total in the 5 piles? *(3 marks)*

(11) Helen is told the equation $2x + 3y = 18$ is true and she is also told that x and y are both positive integers.

(a) Given the equation is true, find the value of $4x + 6y$. *(1 mark)*

(b) Write an expression in terms of x and y that gives the value of 54. *(2 marks)*

(c) By considering possible pairs of numbers, find the values of x and y such that $2x + 3y = 18$. *(3 marks)*

(12) The ratio of men to women to children at a party was 2:1:7. Given there were 35 children at the party, find the number of men that went to the party. *(3 marks)*

(13) Solve the equation: $1 + 4p = 7p - 14$ *(3 marks)*

(14) Factorise the following: (a) $5p - 10$ (b) $6xy + 8x$ *(2 marks)*

(1) Solve the inequality $2x - 1 > x + 7$ *(2 marks)*

(2) John is thinking of 3 numbers. The first number is a multiple of 8 **and** greater than 30. The second number is single digit factor of 32 and the third number is double digit prime number. He adds the 3 numbers together. What is the minimum the sum of the 3 numbers could be? *(4 marks)*

(3) Mark on the diagram below two angles that are co interior. Use x's to show each angle. *(2 marks)*
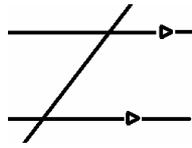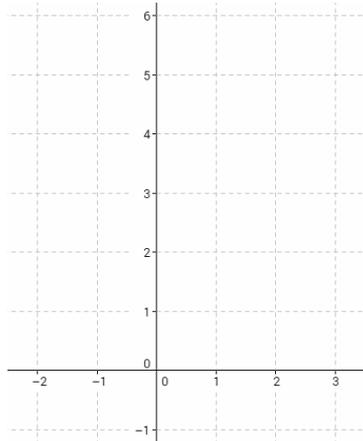

(4) Show that 38% of 200 is more than 4/5 of £85. *(3 marks)*

(5) Fred buys a boat for £400 and sells it for £700. Find the percentage profit he made on the boat. *(3 marks)*

(6) Find the value of y rounding your answer to 2 decimal places. *(3 marks)*

(7) (a) Complete the table below for $y = 2 + 0.5x$ *(2 marks)*

x	-2	-1	0	1	2	3
y					3	3.5

(b) Draw the graph of $y = 2 + 0.5x$ for $-2 \leq x \leq 3$ on the grid below. *(3 marks)*


(8) Without using a calculator, find: (a) $-3 + 7$ (b) $\dfrac{(-4)}{2}$ (c) -4×6 *(3 marks)*

(9) The probabilities of Bob winning a game, losing a game or drawing a game are all equal. Find out how many games you would expect him to either draw **or** lose if he played 600 games. *(3 marks)*

(10) (a) Plot the points $A(-3, 1)$ and $B(1, 5)$ on the grid below. *(2 marks)*

(b) Find the coordinates of the midpoint of A and B. Label the point M on the grid. *(2 marks)*

(c) Draw a line perpendicular to the line through A and B that passes through the point M. *(2 marks)*
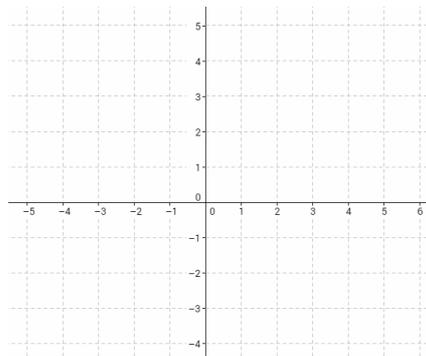
(d) The point C has positive coordinates and the triangle ABC is an isosceles **and** right angled triangle. Given the line AC is parallel to the x axis, find the area of triangle ABC. *(3 marks)*

(11) Solve the equation: $3(x - 1) = 6(x + 2)$ *(3 marks)*

(1) (a) Using **both** letters and numbers on the cards below, make a game where: *(4 marks)*
- *The probability of picking an even number is 0.4.*
- *The probability of picking a square number is one fifth.*
- *The probability of picking a letter is twice as likely as picking a square number.*

(b) Explain why the probability of picking any **one** number or letter in the game will never be 'evens'.*(1 marks)*
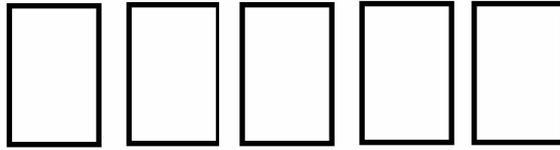
(2) (a) Bob is selling his house for one million pounds. The estate agent will receive 1/8th of the money and £110'000 will be spent on legal fees. How much money will Bob be left with from the sale of his house after these two deductions are made? *(3 marks)*

(b) Bob bought the house 10 years ago for £800'000. Find the percentage increase in the value of the house from when he bought the house to when he sold the house for one million pounds. *(3 marks)*

(3) Jesse wants to join the local Keep Fit class. The class is held on Monday night, Tuesday night and Friday night. She only wants to attend the class twice a week.

(a) List out all the possible combinations of two nights she could go on. *(1 mark)*

(b) One week the Tuesday class is cancelled. Using your answer from part (a), find the probability that Jesse still manages to go to the Keep Fit class twice in that week. *(2 marks)*

(4) Write down the reciprocal of (a) 4 and (b) 2/5 *(2 marks)*

(5) (a) Draw one line parallel to and two lines perpendicular to the line *AB* below. *(2 marks)*

(b) Draw the points *C* and *D* on each of the diagrams below such that *ABCD* is:
   (i) a parallelogram   (ii) a trapezium   (iii) a kite.   *(6 marks)*

(i)   (ii)   (iii)

(6) List all of the numbers that are both factors of 36 **and** square numbers. *(3 marks)*

(7) Simplify the following expressions: (a) $2p - y + 4y - p$ (b) $3(x - y) + 2y - x$ *(2 marks)*

(8) Without using a calculator find the value of: (a) $3(-7)$ (b) $\dfrac{2}{-4}$ (c) $4 + -7$ (d) $-3 - -4$ *(3 marks)*

(9) Write an algebraic expression for (a) twice the value of x and (b) 4 more than three lots of x *(3 marks)*

(10) Jim has $2n$ coins. Fred has 3 times more coins than Jim and Sue has 2 more coins than Fred. In total they have 72 coins. By setting up and solving an equation find out how many coins Sue has. *(4 marks)*

(11) Draw 3 different letters that have rotational symmetry of 2 **and** line symmetry of 2. *(3 marks)*

(12) Solve the equations:
(a) $1 - 2x = x - 8$
(b) $2(x - 1) = 4(x + 2)$ *(4 marks)*

(13) Decrease £33 by 12% *(2 marks)*

(14) Find the common factors of both 10 and 25. *(2 marks)*

(1) The formula $g = \dfrac{2a+1}{3}$ is used to work out how many grams (g) of medicine should be given to a child aged (a) years.

(i) Find out how many grams should be given to a ten year old child. *(2 marks)*

(ii) Explain why a child would never be given 10 g of the medicine. *(2 marks)*

(2) Bob, Fred and Sue each earn some money. Bob earns twice the mean amount of money, Fred earns the median amount of money and Sue earns the least amount. Given they all earn less than £10 each find what each person could have earned. *(4 marks)*

(3) James needs a total of 3.2kg of mud for his garden. He has a pile with 38g, a pile with 1.07kg, a pile with 1323g and a pile with 0.971kg. Does he have enough mud for his garden? *(3 marks)*

(4) The pie chart below shows information about the way people liked to dine. 2/3 chose to eat out.

(a) Mark the size of the angle for each of the sections below. *(3 marks)*

(b) Given 24 people chose 'Eat out' find the number of people surveyed. *(2 marks)*

Favourite way to dine

Eat in

Eat out
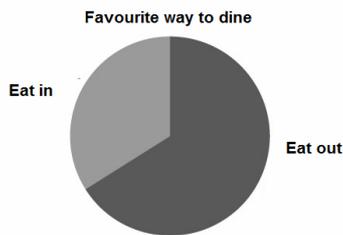
(5) (a) Find the integer value of x such that it's the median of the numbers $3, x, 7, 2, 5, 11, 9$ *(3 marks)*

(b) What will happen to the median if the number 13 is added to the numbers above? *(2 marks)*

(c) Find the mean of the list of numbers. *(3 marks)*

(d) What will happen to the mean of the numbers if the number 4 is added to the list? *(2 marks)*

(e) What will happen to the range of the numbers if the number 1 is added to the list? *(2 marks)*

(6) At the cinema Adult tickets cost £5 and child tickets cost £3.50. Find out how many of each Bob bought if his bill was £24 *(3 marks)*

(7) (a) Put these numbers in an ordered stem and leaf diagram: 21, 12, 13, 15, 7, 23, 34, 41, 23, 17, 9 *(3 marks)*

(b) Show that the range of the numbers is double the value of the median of the numbers. *(3 marks)*

(8) (a) Draw a frequency chart from the table below. *(3 marks)*

Worm length	Frequency
$0 < l \le 2$	5
$2 < l \le 5$	1
$5 < l \le 7$	7
$7 < l \le 11$	3
$11 < l \le 14$	2
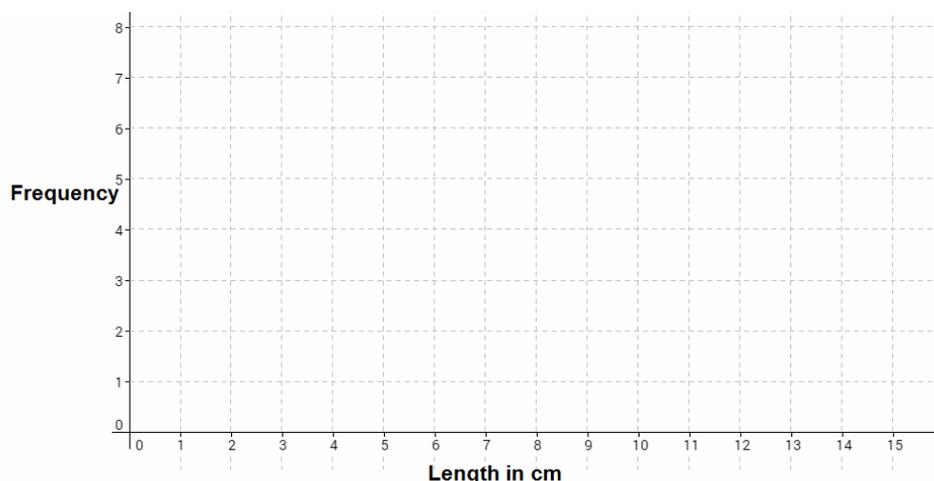
(b) State the modal group from the data. *(1 mark)*

(c) Draw a pie chart to represent the information in the table above. *(3 marks)*

(10) Sketch a graph showing (i) Positive correlation (ii) Negative correlation and (iii) No correlation *(3 marks)*

(1) Harry is n years old. Bob is one year younger than Harry and Jane is one year older than twice Harry's age. Given their combined age is 36, set up and solve an equation to find how old Jane is. *(4 marks)*

(2) Use the spreadsheet below to find out how much tax someone would pay if they earned: *(4 marks)*

(i) £17500

(ii) £21000

(iii) £8000

Earnings	£0 < E ≤ £9000	£9000 < E ≤ £19000	£19000 < E
Tax	£375	$0.17 \times E$	$\dfrac{E}{4} - £2000$

(3) Mike runs a taxi business. He charges £2 per mile and a fixed cost of £10.

(a) Write a formula for the cost (C) and the number of miles (M). *(3 marks)*

(b) Find (i) The cost of travelling for 10 miles and (ii) The number of miles travelled if the bill is £36. *(3 marks)*

Fred also runs a taxi business. He charges £3 a mile and no fixed charge.

(c) The Jones family have a 10 mile journey to make. Show that it doesn't matter which taxi company the use as the cost will be the same. *(2 marks)*

(4) Jackie sells burgers, pizzas and chick nuggets in the ratio 3:2:2. One day she sells between 50 and 60 items. Find the maximum number of pizzas she could have sold. *(3 marks)*

(5) (a) John gets the train to work each week. His fare is set to increase by 12% next year. The fare is currently £140 a week. Find out the cost the fare will be each week next year. *(2 marks)*

(b) In two years the price is expected to be £180 a week. Find the percentage increase on the original fare of £140. *(3 marks)*

(c) Jon earns £1000 a week. Find the % of his current salary he spends on his train fair each week. *(2 marks)*

(6) The bar chart below shows information about relationships.
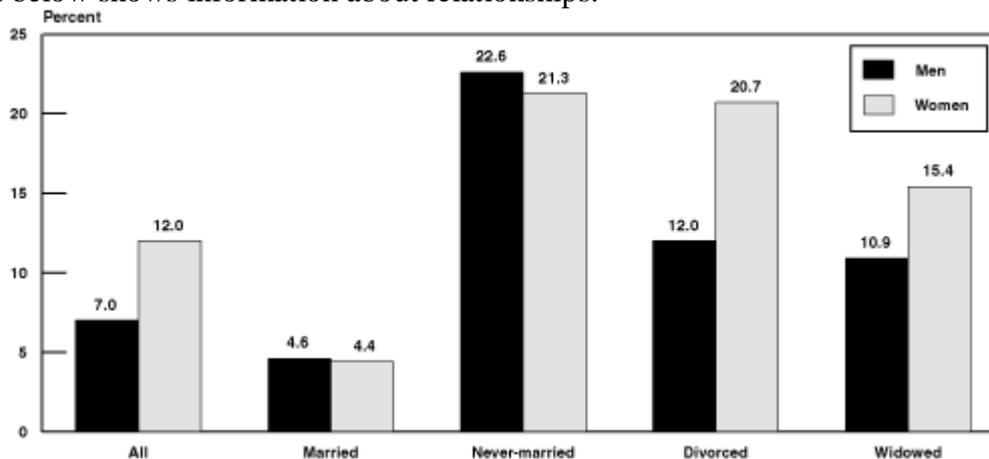
(a) Write down the modal group. *(2 marks)*

(b) Find the difference between the % of Divorced Men and Married Women. *(2 marks)*

(c) Which group is most consistent for both Men and Women? *(2 marks)*

(7) A football pitch costs £80 to hire for the day. The ratio of adults to children is 1:10. Adults pay £3 and children pay £2. Find the minimum number of each required to be able to afford to hire the pitch. *(2 marks)*

(8) The distance hart below shows the distance between 5 different locations.

Town A				
50	City B			
28	42	Village C		
54	96	55	Hamlet D	
38	66	22	38	Country E

(a) Find the distance of a round trip from Hamlet D to City B. *(2 marks)*

(b) Petrol costs £1.50 a litre and one litre can do 12 miles. Find the cost of a journey from Village C to Country E **via** Town A. *(5 marks)*

(c) Fred is offered 11% off his bill. Find the bill after the deduction to the nearest penny. *(2 marks)*

(9) To make a cookie you need 100g of flour, 50g of sugar, 45ml of milk and 1 egg. Find the maximum number of cookies you can make if you have half a kilo of flour, 300g of sugar, 250ml of milk & 8 eggs. *(3 marks)*

(10) (a) Draw a pictogram to represent 20 black cars, 12 red cars, 8 green cars and 5 yellow cars. *(3 marks)*

(b) Find the probability if one car is chosen at random it's neither red nor yellow. *(2 marks)*