Maths Problem Solving Starters

Levels 1 – 3

Name: Worked solutions

Class: _____

Teacher: _____

Remember:

- You will need: pen, pencil, rubber and a ruler.
- Check your work carefully.
- Show all of your working out, with clear steps.

1. Sumire can record up to 40 hours of television programmes on her TV recorder. She has already recorded 35 hours of programmes on the recorder. She wants to keep all these recordings. There are three more programmes Sumire wants to record.

Game show	50 minutes	
Film	2 hours	40 minutes
Reality show	1 hour	35 minutes

Can Sumire record all three programmes on her TV recorder? You must show all your working.

50
160
95 +
305 minutes (1)

40 − 35 = 5 hours left. (1)
5 hours = 300 minutes. (1)
Sumire cannot record all the programmes. (1)

/ 4

2. Daniel carried out a survey of his friends' favourite flavour of crisps. Here are his results.

Plain ✓	Chicken ✓	Bovril ✓	Salt and vin. ✓	Plain ✓
Salt and vin. ✓	Plain ✓	Chicken ✓	Plain ✓	Bovril ✓
Plain ✓	Chicken ✓	Bovril ✓	Salt and vin. ✓	Bovril ✓
Bovril ✓	Plain ✓	Plain ✓	Salt and vin. ✓	Plain ✓

(a) Show this information in a diagram.

(1) (1) (1)

Flavour	Tally	Total
Plain	𝍸 III	8
Salt & vinegar	IIII	4
Bovril	𝍸	5
Chicken	III	3

(b) Write down the number of Daniel's friends whose favourite flavour was Salt & Vinegar. 4 (1)

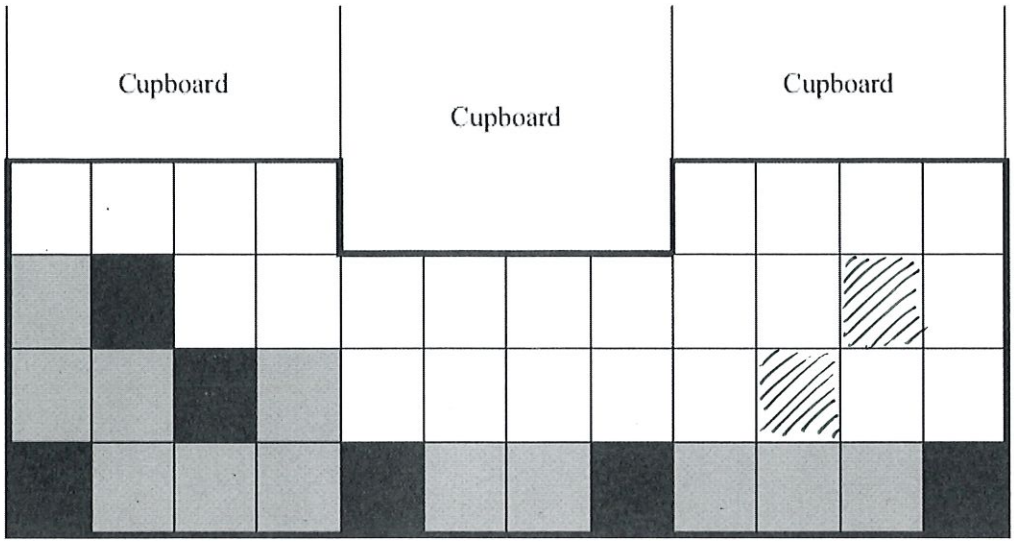
(c) Which was the favourite flavour of most of Daniel's friends?

(1) Plain

/ 5

3.	40 members of Arwick Youth Club go on a trip to a leisure centre. They go in minibuses that can each seat up to 15 people. It costs £30 for each minibus and £150 for the group to have use of the leisure centre. How much will the trip cost per person? 3 minibuses needed (2) 3 × £30 + £150 = £240 total (2) £240 ÷ 40 = £6 each. (1) (1)	/ 6
4.	Simon spent ¼ of his wages on rent. He spent 20% of his wages on food. He spent 0.15 of his wages on clothes Work out the fraction of his wages that he had left. $1 - (\frac{1}{4} + 20\% + 0.15)$ $= 1 - (0.25 + 0.2 + 0.15)$ (1) $= 1 - 0.6$ $= 0.4$ (1) $= \frac{4}{10}$ or $\frac{2}{5}$ (1)	/ 3

5. The diagram shows a partly tiled wall.



Alfie is tiling the wall with black and grey tiles. He is going to use a total of 10 black tiles. Alfie is going to make a symmetrical pattern with the tiles.

(a) (i) On the diagram, show where Alfie could put the 4 black tiles he has left. 2 on diagram + 2 (1) (1)

(ii) Work out the total number of grey tiles that Alfie uses to tile the wall.

(1)

34

Alfie has 4 boxes of grey tiles and 1 box of black tiles.
Each box of tiles costs £6.20

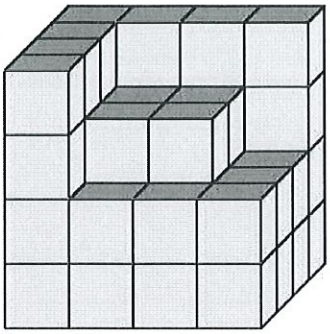
(b) Work out the total cost of the tiles.

5 × £6.20 = £31
(1) (1)

£ 31

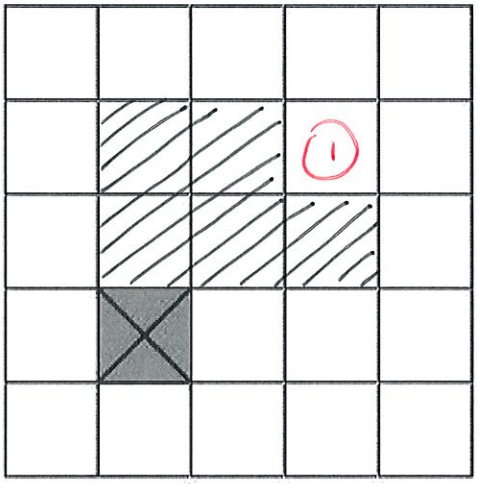
/ 5

6. 64 small cubes are used to build a larger cube. How many of the small cubes are still missing?

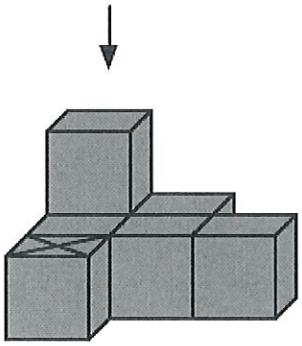


14 (1)

7 cubes are used to make this shape. Shade squares on this grid to show the plan of the shape. One cube has already been marked on the grid.



(1)



/ 2

7. The table gives information about an estate agent's charges for selling a house.

Value of house	Estate agent's charges
Up to £60 000	2% of the value of the house
Over £60 000	2% of the first £60 000 plus 1% of the remaining value of the house

Ken uses this estate agent to sell his house. The estate agent sold Ken's house for £80 000. Work out the total charge that Ken will have to pay.

£80 000 − £60 000 = £20 000 (1)

2% of £60 000 = £1200 (1)

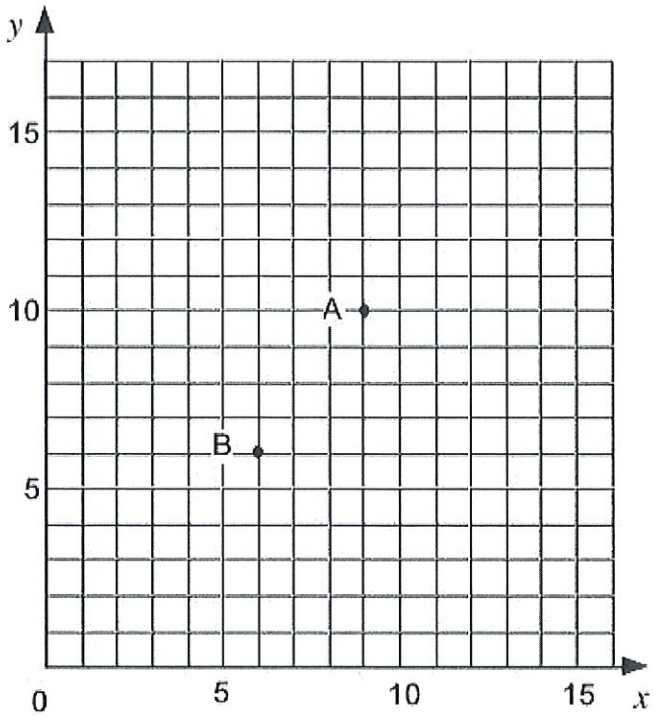
1% of £20 000 = £200 (1)

£1200 + £200 = £1400 (1)

£ 1400

/ 4

8.	Mrs Miller is planning a party for 70 children. She will give each child a party bag to take home. She will put a hat and a toy in each party bag. Party bags are sold in packs of 12 Hats are sold in packs of 8 Toys are sold in packs of 9 Mrs Miller buys the smallest possible number of packs of hats, toys and bags. Mrs Miller can fill more party bags than she needs. How many more? 12 24 36 ... 8 16 24 ... 9 18 27 ... (1) LCM of 12, 8 and 9 = 72 (1) 72 - 70 = 2 bags (1) (1)	/ 4
9.	A supermarket sells 500g pots of yoghourt. There is a special offer on yoghourt: **Buy 2 pots and get a 3rd one free!** A week later, the price of a single pot of yoghourt is still the same, but the offer changes to: **Buy 1 pot and get a second one half price!** Is the second offer better than the first? Show working to justify your answer. First offer : 6 pots → pay for 4 (1) Second offer : 6 pots → pay for 4.5 (1) first offer is better as pay for fewer pots. (1) (1)	/ 4

10.	The two points A and B on the grid are the vertices of an isosceles triangle. A is at (9, 10); B is at (6, 6). (a) The other vertex of the isosceles triangle is at a point with whole number coordinates. What could be the coordinates of the other vertex? (____ , ____)  (b) There are several other points with whole number coordinates that could be the vertex of the isosceles triangle. Give the co-ordinates of two more of these points. Any of : (1, 6), (2, 3), (6, 1), (9, 2), (10, 3), (11, 6) etc. (3) (____ , ____) and (____ , ____)	/ 3
11.	A bag contains only red counters and blue counters. There are 90 red counters in the bag. The probability of choosing a red counter from the bag is 0.3. How many blue counters are in the bag? red : blue 0.3 : 0.7 (1) 90 : 210 (1)	/ 2
12.	A set of five numbers has: a mode of 12 a median of 11 a mean of 10 What could the numbers be? (1) (1) a b 11 12 12 where a + b = 15 (1)	/ 3

13. Mr and Mrs Ledger took their grandson Harry to Chic's Diner.

Chic's Diner

Menu

Starters			**Deserts**	
Prawn Cocktail	£4.50		Ice cream	£2.80
Pate and toast		£4.95	Apple pie	£3.20
Soup of the day		£3.50	Cheesecake	£3.50
Melon		£2.90		
			Drinks	
Main course			White wine	£11.50 per bottle
Fish and chips		£7.85	Red wine	£12.25 per bottle
Steak and chips		£12.25	Fruit juices	£2.10 per glass
Gammon and chips		£9.75		

Add 10% service charge

Mr Ledger started with soup. He had steak and chips for his main course and ice cream for dessert.
Mrs Ledger started with a prawn cocktail and a main course of fish and chips. She did not have a desert.
Harry didn't have a starter. He had a main course of fish and chips and ice cream for dessert.
Mr and Mrs Ledger shared a bottle of red wine. Harry had a glass of fruit juice.

(a) Work out the total bill including the service charge.

3.50
12.25
2.80
4.50
7.85
7.85
2.80 +
41.55
3 4 1

(2)

41.55
12.25
2.10 +
55.90
1

10% of 55.90
= 5.59 (1)

55.90
5.59 +
61.49
1 1

(1)

£61.49

Chic has now increased all of his prices by 6%.

(b) Work out the new price of fish and chips.

(1)

6% of 7.85
5% = 0.39
1% = 0.08 +
0.47
1

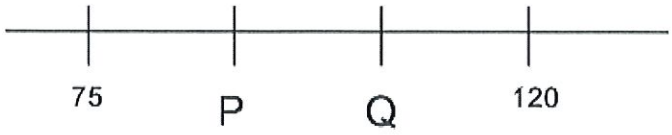
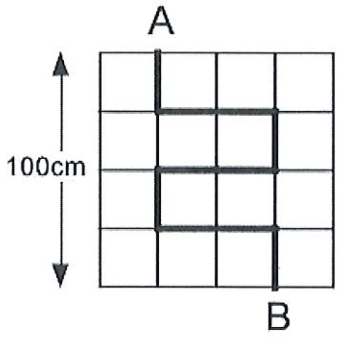
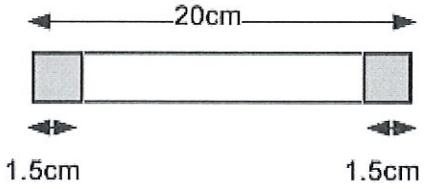
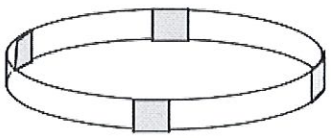
(1)

7.85
0.47 +
8.32
1 1

(1)

£8.32

/ 7

14.	Four numbers are equally spaced on a number line.  Find the numbers represented by P and Q P = 90 (1) Q = 105 (1)	/ 2
15.	Here is a block of squares. Find the length of the thick line that goes from A to B.  100 ÷ 4 = 25cm (1) 10 × 25 = 250cm (1) 250 cm	/ 2
16.	A length of paper is 20cm long. It has a 1.5 cm sticky strip at each end. Four strips are stuck together, with the sticky parts overlapping exactly, to make a loop of paper. What is the circumference of the loop?   (1) 20 − 1.5 = 18.5cm (1) 18.5 × 4 = 74cm (1) (1) 74 cm	/ 4

17. Here are some fractions.

$\frac{2}{8}$ $\frac{3}{10}$ $\frac{4}{16}$ $\frac{5}{20}$ $\frac{8}{24}$

(a) Which two of the fractions are not equivalent to
You must show your working.

$\frac{2}{8} = \frac{1}{4}$ $\frac{5}{20} = \frac{1}{4}$ (1)

$\frac{4}{16} = \frac{1}{4}$ $\frac{8}{24} = \frac{1}{3}$

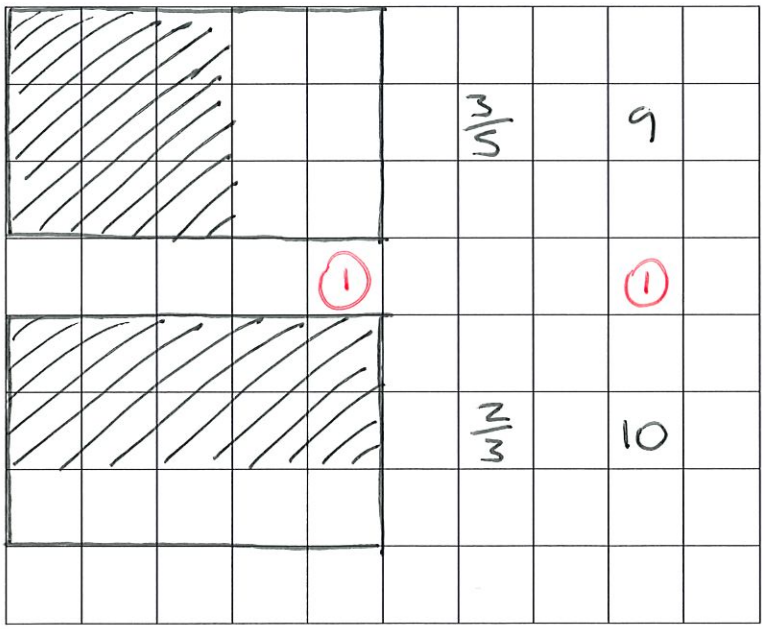
(1) (1)

$\frac{3}{10}$ and $\frac{8}{24}$

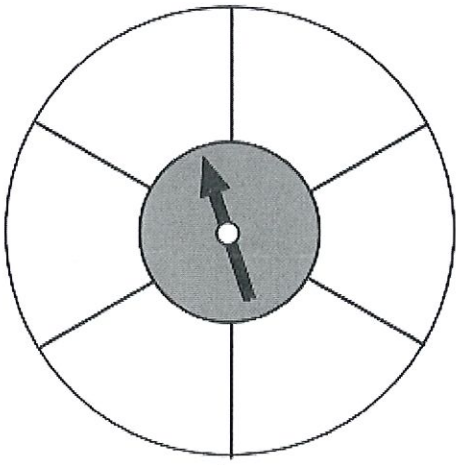
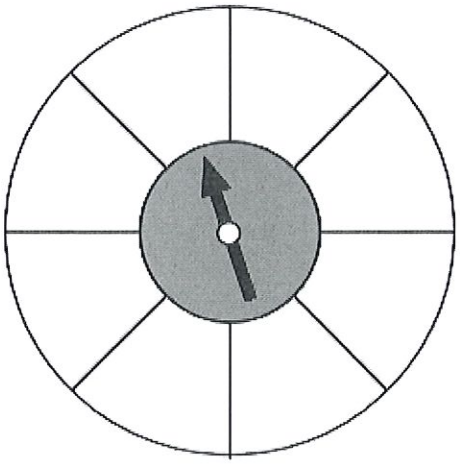
(b) Here are two fractions.

$\frac{3}{5}$ $\frac{2}{3}$ (1)

Explain which is the larger fraction.



/ 6

18.	Explain why the 1st of April is always on the same day of the week as the 1st of July. April → 30 days May → 31 days (1) June → 30 days Total 91 days (2) 91 is a multiple of 7 (days in a week). (2)	/ 5
19.	Spinner A has 6 equal sections and spinner B has 8 equal sections. Each section of the spinners contains the number 1, 2 or 3. All three numbers appear on each spinner. Write numbers in the spinner sections so that: • a score of 1 is more likely on spinner A than spinner B, • a score of 2 is more likely on spinner B than spinner A, • a score of 3 is equally likely on either spinner. Spinner A  Spinner B 	/ 3

A: 1 2 2 3 3 3 and B: 1 2 2 2 3 3 3 3

OR

A: 1 1 2 3 3 3 and B: 1 2 2 2 3 3 3 3.

(1) 1s correct
(1) 2s correct
(1) 3s correct.

20. Daniel wants to buy a laptop.
Two shops sell the same make of laptop.

Arnold's Computers

£630

Special offer:
1/3 off all prices

Laptop World

Pay £100
plus
12 monthly payments of £30

Daniel wants to pay the least amount of money for his laptop.
Which of the two shops should Daniel buy the laptop from?
You must show all of your working.

Arnold's computers:
$\frac{1}{3}$ of £630 = £210 (1)
£630 − £210 = £420 (1)

Laptop world:
£100 + 12 × £30
= £460 (1)

Daniel should buy from Arnold's computers. (1)

/ 4

21. Last year Kerry's take home pay was £15 000
She spent 40% of her take home pay on rent.
She used the rest of her take home pay for living expenses, clothes and entertainment in the ratio 3 : 1 : 2
How much did Kerry spend on entertainment last year?

10% of £15 000 = £1500
40% of £15 000 = £6000 (rent) (1)
£15 000 − £6000 = £9000 (1)
£9000 ÷ 6 = £1500 (1)
£1500 × 2 = £3000 (1)

£ 3000

/ 4

22.	Robert is in hospital. He takes a pill every 6 hours. He has some medicine every 8 hours. He has an injection every 12 hours. At 08 00 on 10th July, Robert took a pill, had some medicine and an injection. At what date and time will Robert again have all three together? You must show your working. 6 12 18... 8 16 24... 12 24 36... (1) LCM of 6, 8 and 12 = 24 hours (1) (1) 0800 on 11th July	/ 3
23.	Angela earns £35 240 a year. She has to pay income tax. She is allowed to earn £6475 before paying tax. She pays 20% tax on the rest. Her employer deducts the income tax each month. Work out how much income tax Angela gets deducted each month. 35240 − 6475 = 28765 (1) 10% of £28 765 = £2876.50 20% of £28 765 = £5753 (1) 12 ⟌ 5753.5000 = 479.415 (1) £479.42 per month. (1)	/ 4
24.	Lottie has a bag of apples. She gives half of them to Fred. Fred eats two and then has four left. Use algebra to determine how many apples Lottie had at the start. $\frac{x}{2} - 2 = 4$ (1) $\frac{x}{2} = 6$ (1) $x = 12$ (1) 12	/ 3

25. A customer who cancels a holiday with Funtours has to pay a cancellation charge. The cancellation charge depends on the number of days before the departure date the customer cancels the holiday. The cancellation charge is a percentage of the cost of the holiday. The table shows the percentages.

Number of days before the departure date the customer cancels the holiday	**Percentage of the cost of the holiday**
29–55	40%
22–28 *	60%
15–21	80%
4–14	90%
3 or less	100%

The cost of Amy's holiday was £840. She cancelled her holiday 25 days before the departure date.

(a) Work out the cancellation charge she had to pay.

60% of £840

50% = £420 (1)

10% = £ 84

£504 (1)

£ 504

The cost of Carol's holiday was £600. She cancelled her holiday and had to pay a cancellation charge of £480.

(b) Give the range of the number of days in which Carol cancelled her holiday.

$\frac{480}{600} \times 100 = \frac{8}{10} \times 100 = 80\%$ (1) (1)

(1)

15 - 21

/ 5

26. Viv is training to keep fit. One part of Viv's training session is a 40 second run followed by a 2 minute walk. She repeats this run and walk 5 times. Before doing this, she does some warm-up exercises for 10 minutes. Afterwards she does a 10 minute cooling down exercise. Viv started this training session at 12 30

(a) At what time, to the nearest minute, did Viv finish her training session?

40 secs + 2 mins = 160 secs

160 secs × 5 = 800 secs.

= 13 mins 20 secs (1)

(1) 13 mins + 10 mins + 10 mins = 33 mins (1)

12 30 + 33 mins = 1303

(1)

1303

To help her training, Viv has energy drinks. She buys a pack of 12 energy drinks for £9.18

(b) Work out the cost of one energy drink. Give your answer correct to the nearest penny.

$$12 \overline{)9.18^{6}0} \quad 0.765$$ (1)

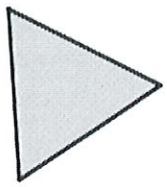
(1)

(1)

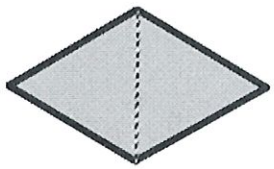
£ 0.77

/ 7

27.



perimeter = 12 cm



An equilateral triangle has a perimeter of 12 cm. Two of the triangles are joined together, edge to edge. What is the new perimeter?

$12 \div 3 = 4cm$ (1)

$4 \times 4cm = 16cm$ (1)

16 cm

/ 2

28. Mr Williams is organising a school trip. Going on the school trip there will be

- 134 students from Year 8,
- 125 students from Year 9,
- and 30 adults.

Mr Williams must hire enough coaches so that everyone on the trip has a seat. All the coaches that Mr Williams can hire seat 54 people. What is the smallest number of coaches that Mr Williams has to hire? You must show all your working.

$$\begin{array}{r} 134 \\ 125 \\ 30 + \\ \hline 289 \end{array}$$ (1)

$289 \div 54 = 5 \text{ r } 19$ (1)

6 coaches needed. (1)

6

/ 3

29. Janice asks 100 students if they like biology or chemistry or physics best.

- 38 of the students are girls.
- 21 of these girls like biology best.
- 18 boys like physics best.
- 7 out of the 23 students who like chemistry best are girls.

Work out the number of students who like biology best.

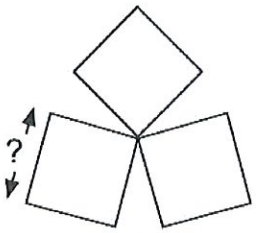
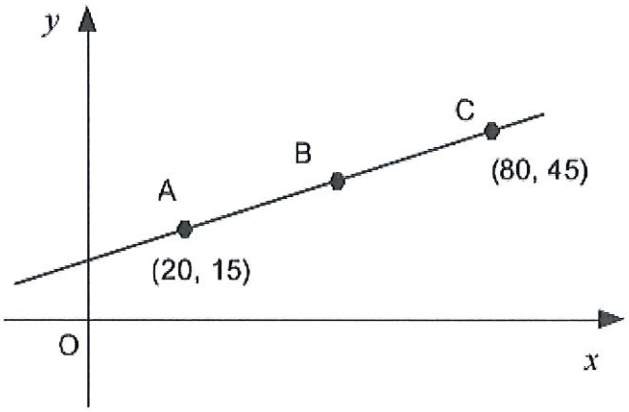
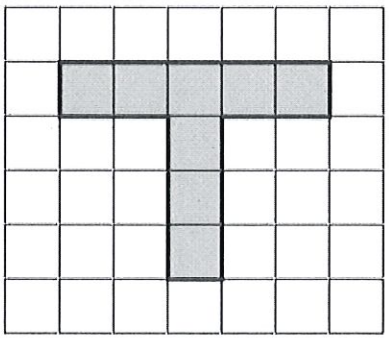
	Girls	Boys	Total
Chem	7	16	23
Bio	21	28	(49)
Phys	10	18	28
Total	38	62	100

(1)

49

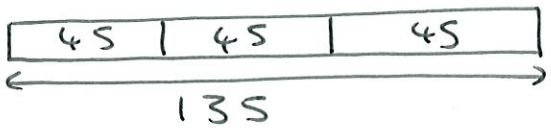
/ 4

(1) Draw table
(1) Fill in given info
(1) Fill in rest of table.

30.	A piece of wire is 60cm long. It is bent into a shape that consists of three identical squares. How long is the side of a square? 60 ÷ 12 sides = 5cm (1)  (1) 12 sides (1) 5 cm	/ 3
31.	The three points, A, B and C, on this graph are equally spaced. What are the co-ordinates of point B?  not drawn accurately $\frac{20+80}{2} = 50$ (1) $\frac{15+45}{2} = 30$ (1) (50 , 30)	/ 2
32.	The letter 'T' on this square grid has an area of 200cm². Calculate the perimeter of the 'T'.  200 ÷ 8 squares = 25cm² (1) $\sqrt{25}$ = 5cm (1) 18 x 5 = 90cm (1) (1) 90 cm	/ 4

33.	Mr Shah is working out the cost of the electricity he used in April. **Electricity Meter Readings** 1 April 79721 30 April 80305 Mr Shah has to pay 20p for each of the first 70 units used in April and 10p for each of all the other units used in April. Work out the total cost of the electricity he used in April. ~~7~~ ~~8~~ ~~9~~ ~~10~~ ~~11~~ ~~12~~ 305 79721 − 00584 (1) 584 − 70 = 514 units. (1) 0.2 × 70 = £14.00 (1) 0.1 × 514 = £51.40 + £65.40 (1) £ 65.40	/ 4
34.	The length of a flight from Krakow to Liverpool is 2 hours 50 minutes. The 17 15 (Krakow time) flight from Krakow to Liverpool is delayed by 75 minutes. The time in Krakow is one hour ahead of the time in Liverpool. Work out the time (Liverpool time), that the flight is due to arrive in Liverpool. Flight leaves at 1830 (1) Flight arrives (krakow time) at 2120 (1) (Liverpool) at 2020 (1) 2020 There are 228 passengers on the flight. Two thirds of the passengers did not have a meal during the flight. How many passengers had a meal during the flight? $\frac{1}{3}$ of 228 (1) 76 3⟌228 (1) (1) 76	/ 6

35. A length of tape is 135 centimetres long. It is cut into two pieces. The first piece is twice as long as the second piece. How long is the shorter of the two pieces of tape?



(1)

$3\overline{)135}$ = 45 (1)

(1) 45 cm

/ 3

36. Mrs Long has to buy 270 chocolate biscuits. She finds chocolate biscuits at 3 different shops.

Shop A	Shop B	Shop C
9 biscuits in a pack	18 biscuits in a pack	27 biscuits in a pack
£1.80 per pack	£2.50 per pack	£2.60 per pack
Buy one pack and get one extra pack free	Buy two packs and get one extra pack free	

In which shop are the biscuits cheaper? You must show your working.

270 ÷ 9 = 30
Pay for 15
15 × £1.80
= £27.00 (1)

270 ÷ 18 = 15
Pay for 10
10 × £2.50
= £25.00 (1)

270 ÷ 27 = 10
10 × £2.60
= £26.00 (1)

Biscuits are cheaper from Shop B. (1)

/ 4

37. The diagram shows a wall in Vicky's living room.

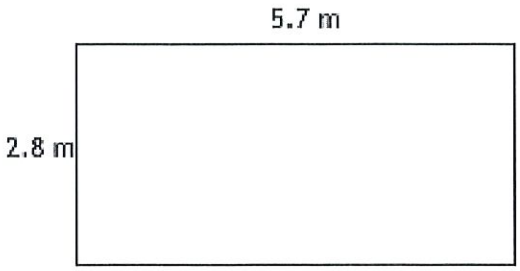


Diagram NOT accurately drawn

Vicky plans to wallpaper this wall. She buys some rolls of wallpaper.

Each roll of wallpaper is 53 cm wide and 12 m long. The cost of one roll of wallpaper is £12.45.

Work out the cost of wallpapering the wall.

5.7m ÷ 53cm = 11 rolls needed. (1)

11 × 2.8 = 30.2 m needed. (1)

3 rolls needed. (1)

3 × £12.45 = £37.35

(1) (1)

£ 37.35

/ 5

38. T-shirts normally cost £12 each. Two shops have a special offer on these T-shirts.

T-Shirts-R-Us

Special offer
Pay for 3 T-shirts and get 2 free.
Buy more than 10 T-shirts and get a further 20% off

Budget Shirt Company

Special offer
½ off normal price

Stephen wants to buy exactly 30 T-shirts. Work out at which shop, Stephen will get the better deal. You must show clearly how you got your answer.

T Shirts R Us

Pay for 18 shirts

18 × £12 = £216 (1)

20% of £216
= £43.20 (1)

£216 - £43.20
= £172.80 (1)

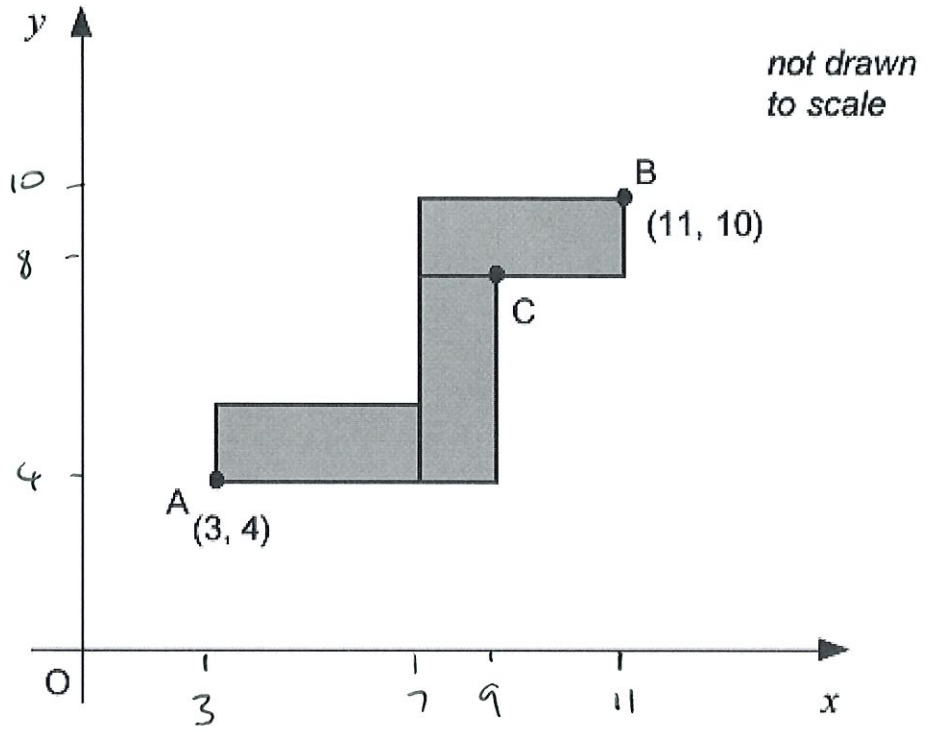
Budget Shirt Co

30 × £6 = £180 (1)

Stephen will get a better deal at T Shirts R Us. (1)

/ 5

39.



The diagram shows three identical rectangles that have their sides parallel to the axes.

(a) What are the dimensions of each rectangle?

$11 - 3 = 8$ (1)

$8 \div 2 = 4$ (1)

$10 - 8 = 2$ (1)

(1) (1)

4×2

(b) Find the co-ordinates of point C

(1) (1)

(9 , 8)

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