Name: _____

Ratio Problems

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

Linda is going on holiday to the Czech Republic.
She needs to change some money into koruna.

She can only change her money into 100 koruna notes.

Linda only wants to change up to £200 into koruna.
She wants as many 100 koruna notes as possible.

The exchange rate is £1 = 25.82 koruna.

How many 100 koruna notes should she get?

. . . . . .

(Total for Question is 3 marks)

Q2.

There are only blue cubes, red cubes and yellow cubes in a box.

The table shows the probability of taking at random a blue cube from the box.

Colour	blue	red	yellow
Probability	0.2		

The number of red cubes in the box is the same as the number of yellow cubes in the box.

(a) Complete the table.

(2)

There are 12 blue cubes in the box.

(b) Work out the total number of cubes in the box.

.....

(2)

(Total for question = 4 marks)

Q3.

There are 100 beads in a bag.

50 of the beads are red
25 of the beads are blue
15 of the beads are green
The rest of the beads are yellow

Sally takes at random a bead from the bag.

What is the probability that the bead is

(a) green,

. . . . . .

(2)

(b) black,

. . . . . .

(1)

(c) yellow?

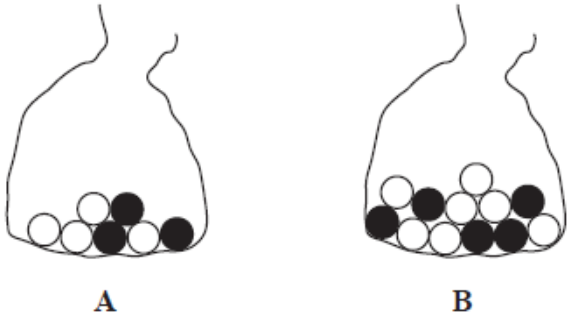
. . . . . .

(2)

(Total for Question is 5 marks)

Q4.

* There are only black balls and white balls in bag **A** and in bag **B**, as shown in the diagram.



A B

Heidi is going to take at random a ball from bag **A** and a ball from bag **B**.

Which bag gives Heidi the greater probability of taking a black ball, bag **A** or bag **B**?
You must show how you get your answer.

(Total for question = 3 marks)

Q5.

Three solid shapes **A**, **B** and **C** are similar.

The surface area of shape **A** is 4 cm^2
The surface area of shape **B** is 25 cm^2

The ratio of the volume of shape **B** to the volume of shape **C** is 27 : 64

Work out the ratio of the height of shape **A** to the height of shape **C**.
Give your answer in its simplest form.

.....

(Total for question = 4 marks)

Q6.

p and q are two numbers such that $p > q$

When you subtract 5 from p and subtract 5 from q the answers are in the ratio 5 : 1
When you add 20 to p and add 20 to q the answers are in the ratio 5 : 2

Find the ratio p : q
Give your answer in its simplest form.

.....

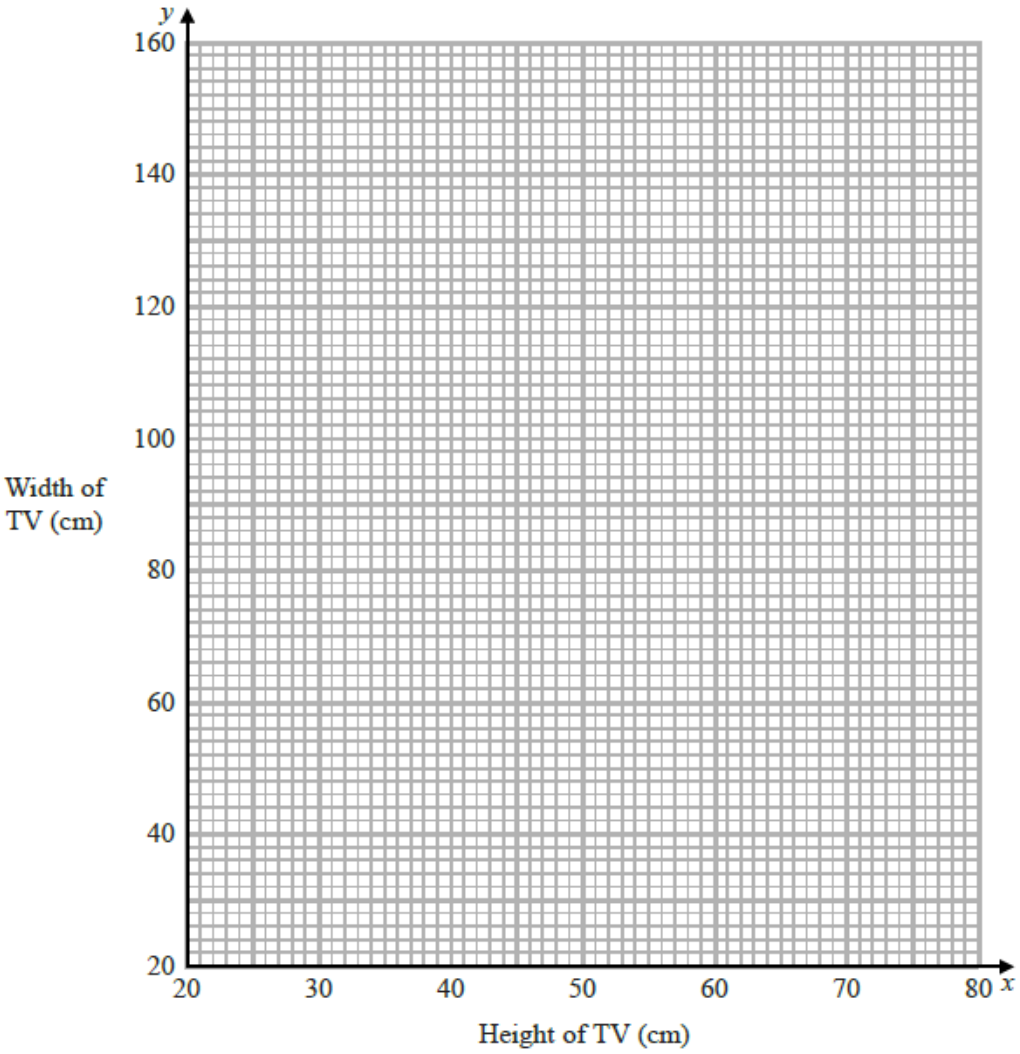
(Total for question = 5 marks)

Q7.

The height (x cm) and the width (y cm) of TVs are in the ratio 9 : 16

(a) Use this information to draw a graph to show the relationship between the height and the width of TVs.

Use values of x from 20 to 80



(2)

A TV has a width of 90 cm.

(b) Use your graph to work out the height of this TV.

..... cm

(1)

(Total for question = 3 marks)

Q8.

Raya buys a van for £8500 plus VAT at 20%

Raya pays a deposit for the van.
She then pays the rest of the cost in 12 equal payments of £531.25 each month.

Find the ratio of the deposit Raya pays to the total of the 12 equal payments.
Give your answer in its simplest form.

.....

(Total for question = 5 marks)

Q9.

A shop sells packs of black pens, packs of red pens and packs of green pens.

There are

2 pens in each pack of black pens
5 pens in each pack of red pens
6 pens in each pack of green pens

On Monday,

$$\text{number of packs of black pens sold} : \text{number of packs of red pens sold} : \text{number of packs of green pens sold} = 7 : 3 : 4$$

A total of 212 pens were sold.

Work out the number of green pens sold.

.....

(Total for question = 4 marks)

Q10.

There are 60 people in a choir.
Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir.
The rest of the people in the choir are children.

the number of children in the choir : the number of men in the choir = n : 1

Work out the value of n.

You must show how you get your answer.

n = ...

(Total for question = 4 marks)

Q11.

Anna and Bill share some money in the ratio 2 : 5

Anna gets £A
Bill gets £B

Carl and Donna share twice as much money as Anna and Bill share.
They share the money in the ratio 3 : 1

Carl gets £C
Donna gets £D

Find A : B : C : D
Give your answer in its simplest form.

.....

(Total for question = 3 marks)

Q12.

There are some small cubes and some large cubes in a bag.
The cubes are red or the cubes are yellow.

The ratio of the number of small cubes to the number of large cubes is 4 : 7

The ratio of the number of red cubes to the number of yellow cubes is 3 : 5

(a) Explain why the least possible number of cubes in the bag is 88

.....

.....

.....

(1)

All the small cubes are yellow.

(b) Work out the least possible number of large yellow cubes in the bag.

.....

(3)

(Total for question = 4 marks)

Q13.

Tom and Adam have a total of 240 stamps.
The ratio of the number of Tom's stamps to the number of Adam's stamps is 3 : 7

Tom buys some stamps from Adam.
The ratio of the number of Tom's stamps to the number of Adam's stamps is now 3 : 5

How many stamps does Tom buy from Adam?
You must show all your working.

.....

(Total for question = 4 marks)

Q14.

The ratio $(y + x) : (y - x)$ is equivalent to $k : 1$

Show that $y = \frac{x(k+1)}{k-1}$

(Total for question = 3 marks)

Q15.

60 children go to a nursery.
The ratio of girls to boys is 3 : 2

The children go to the nursery either in the morning or in the afternoon.

$\frac{3}{4}$ of the children go to the nursery in the morning.

The rest of the children go to the nursery in the afternoon.

7 boys go to the nursery in the afternoon.

Work out how many girls go to the nursery in the morning.

.....

(Total for question = 5 marks)

Q16.

Frank, Mary and Seth shared some sweets in the ratio 4 : 5 : 7
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

.....

(Total for question = 3 marks)

Q17.

Solid **A** and solid **B** are mathematically similar.
The ratio of the surface area of solid **A** to the surface area of solid **B** is 4:9

The volume of solid **B** is 405cm^3.

Show that the volume of solid **A** is 120cm^3.

(Total for question = 3 marks)

Q18.

There are only blue pens, green pens and red pens in a box.

The ratio of the number of blue pens to the number of green pens is 2 : 5
The ratio of the number of green pens to the number of red pens is 4 : 1

There are less than 100 pens in the box.

What is the greatest possible number of red pens in the box?

.....

(Total for question = 3 marks)

Q19.

The points A, B, C and D lie in order on a straight line.

$AB : BD = 1:5$
$AC : CD = 7:11$

Work out $AB : BC : CD$

..... **:** ..... **:** .....

(Total for question = 3 marks)

Q20.

Kim, Laura and Molly share £385

The ratio of the amount of money Kim gets to the amount of money Molly gets is 2 : 5

Kim gets £105 less than Molly gets.

What percentage of the £385 does Laura get?

..... %

(Total for question = 4 marks)

Q21.

$a = \sqrt{7} + \sqrt{c}$ and $b = \sqrt{63} + \sqrt{d}$ where c and d are positive integers.

Given that $c : d = 1 : 9$
find, in its simplest form, the ratio $a : b$

.....

(Total for question = 3 marks)

Q22.

White shapes and black shapes are used in a game.
Some of the shapes are circles.
All the other shapes are squares.

The ratio of the number of white shapes to the number of black shapes is 3:7

The ratio of the number of white circles to the number of white squares is 4:5

The ratio of the number of black circles to the number of black squares is 2:5

Work out what fraction of all the shapes are circles.

.....

(Total for question = 4 marks)

Q23.

John has an empty box.
He puts some red counters and some blue counters into the box.

The ratio of the number of red counters to the number of blue counters is 1 : 4

Linda takes at random 2 counters from the box.

The probability that she takes 2 red counters is $\frac{6}{155}$

How many red counters did John put into the box?

.....

(Total for question = 4 marks)

Q24.

P has coordinates (–9, 7)
Q has coordinates (11, 12)

M is the point on the line segment *PQ* such that *PM* : *MQ* = 2 : 3

Line **L** is perpendicular to the line segment *PQ*.
L passes through *M*.

Find an equation of **L**.

.....

(Total for question = 5 marks)

Q25.

Given that

$2x - 1 : x - 4 = 16x + 1 : 2x - 1$

find the possible values of x.

.....

(Total for question = 5 marks)

Mark Scheme

Q1.

Question		Working	Answer	Mark	Notes
			51	3	M1 200 × 25.82 (= 5164) A1 for 5164 or 5160 or 5100 or 5200 or 51.64 or 51.6(0) or 52 A1 for 51 cao **OR** M1 for 100 ÷ 25.82 (= 3.87...) **and** 200 ÷ '3.87...' (= 51.64) A1 for 5164 or 5160 or 5100 or 5200 or 51.64 or 51.6(0) or 52 A1 for 51 cao

Q2.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	0.4, 0.4	P1	for process to find sum of unknown probabilities, eg 1 – 0.2 (= 0.8)	Award mark for any two probabilities given that sum to 0.8, eg given in the table
		A1	oe	Accept any equivalent fraction or 40%
(b)	60	P1	for complete process to find total number of cubes, eg 12 ÷ 0.2 **or** 12 × 5 **or** ("0.4" ÷ 0.2) ×12 + ("0.4" ÷ 0.2) ×12 + 12 **OR** states 0.1 = 6 **or** 0.4 = 24	
		A1	cao	

Q3.

		Working	Answer	Mark	Notes
	(a)		$^{15}/_{100}$	5	M1 for fraction with 15 as the numerator or 100 as the denominator A1 for $^{15}/_{100}$ oe or 0.15 or 15%
	(b)		0	1	B1 oe Accept $^{0}/_{100}$, 0%, 0 out of 100 but not 0:100
	(c)		$^{1}/_{10}$		M1 for 100 – (50 + 25 + 15) A1 oe

Q4.

Question	Working	Answer	Mark	Notes
*		Bag A (supported)	3	M1 for $\frac{3}{7}$ or $\frac{5}{12}$ M1 (dep) for method to compare the two probabilities, e.g using a common denominator, eg $\frac{3}{7}=\frac{36}{84}$; $\frac{5}{12}=\frac{35}{84}$ or writing as decimals eg $\frac{3}{7}=0.428571...$ and $\frac{5}{12}=0.416666...$ C1 (dep on M2) for Bag A and correct method of comparison with correct figures using $\frac{3}{7}$ and $\frac{5}{12}$

Q5.

Question	Answer	Mark	Mark scheme	Additional guidance
	3 : 10	P1	process to find ratio of lengths $A:B = \sqrt{4}:\sqrt{25}$ (= 2:5 or $\frac{2}{5}$ or 2, 5)	Accept working in fractions for the award of process marks but the final answer must be in correct simplified ratio notation
		P1	for process to find ratio of lengths $B:C = \sqrt[3]{27}:\sqrt[3]{64}$ (= 3:4 or $\frac{3}{4}$ or 3, 4)	
		P1	for process to write as one ratio eg. finding a common multiple of 3 and 5 **or** 6 : 15 : 20 oe	
		A1	cao	

Q6.

Question	Answer	Mark	Mark scheme	Additional guidance
	4 : 1	P1	for associating algebraic expressions with the correct ratio eg $p-5 : q-5$ (= 5 : 1) or $p+20 : q+20$ (= 5 : 2)	
		P1	for $\frac{p+20}{q+20}=\frac{5}{2}$ **or** $\frac{p-5}{q-5}=\frac{5}{1}$ oe **or** $p-5=5(q-5)$ **or** $2(p+20)=5(q+20)$ oe	Award for one of the two simultaneous equations eg $5q-p=20$, $5q-2p=-60$ oe
		M1	for a complete method shown to find p **or** q	Award for a simultaneous equation method to eliminate one variable leading to either $p = 80$ or $q = 20$
		M1	for a complete method shown to find p **and** q **or** two values for p and q that are in the ratio 4 : 1 or an unsimplified ratio 4 : 1 (eg 80 : 20) or an answer of 1 : 4	Award for a simultaneous equation method to eliminate both variables leading to either $p = 80$ **and** $q = 20$
		A1	cao	

Q7.

Question	Working	Answer	Mark	Notes
(a)		Graph drawn	M1	for a line of gradient $\frac{16}{9}$ drawn or at least 2 correct points plotted
			C1	for a fully correct graph drawn
(b)		48 - 52	B1	for answer in the range 48 – 52

Q8.

Question	Answer	Mark	Mark scheme	Additional guidance
	3 : 5	P1	for process to find 20% **or** 120% of the cost, eg 8500 × 0.2 (= 1700) oe **or** 8500 × 1.2 (= 10 200) oe	When partitioning all figures quoted must be correct or a full method shown eg 10% = 8500 ÷ 10 (=850) and 20% = "850" + "850" (=1700)
		P1	for process to find total cost of payments, eg 12 × 531.25 (= 6375)	
		P1	for complete process to find value of deposit, eg "10 200" – "6375" (= 3825) **or** 8500 – "6375" (=2125) **and** "2125" + "1700" (=3825) **OR** the deposit as a proportion of the total cost, eg $1 - \frac{"6375"}{"10200"}$ $(=\frac{3}{8})$	May be seen as a fraction of the total eg $\frac{3825}{10200}$ $(=\frac{3}{8})$
		P1	for finding a correct un-simplified ratio, eg "3825" : "6375" oe **or** 5:3 **or** $1.\dot{6} : 1$ **or** $\frac{5}{3} : 1$	Figures at this stage must be expressed as part of a ratio eg 51:85, $\frac{3}{8} : \frac{5}{8}$
		A1	Accept $1 : 1.\dot{6}$, $1 : \frac{5}{3}$	Ignore consistent units

Q9.

Question	Answer	Mark	Mark scheme	Additional guidance
	96	P1	for process to find the ratio of the number of pens of each colour sold, eg $2 \times 7 : 5 \times 3 : 6 \times 4$ (= 14 : 15 : 24)	Does not have to be seen as a ratio but all three needed
		P1	for process to find the proportion of green pens sold, eg $\frac{212}{"14"+"15"+"24"}$ **or** $\frac{"24"}{"14"+"15"+"24"}$	
		P1	for a complete process to find the number of green pens sold, eg $\frac{212}{"14"+"15"+"24"} \times$ "24" **or** $\frac{"24"}{"14"+"15"+"24"} \times 212$	P3 can be implied by the values 56, 60 and 96
		A1	cao	

Q10.

Question	Answer	Mark	Mark scheme	Additional guidance
	2	P1	for a process to find the number of men, eg. (60 ÷ 2) ÷ 3 (= 10)	
	(supported)	P1	for a process to find the number of children, eg. 60 – "30" – "10" (= 20)	60 ÷ 3 = 20 scores no marks
		P1	for a start of a process to find the value of n, eg. ("20" : "10") ÷ 5 or 20 : 10 = 10 : 5 or "20" ÷ "10"	Any ratio must come from correct processes to find the number of children and the number of men
		A1	for 2 with supportive working	Award 0 marks for 2 with no correct supportive working Award full marks for 2 : 1 given as a final answer from correct supportive working

Q11.

Question	Working	Answer	Mark	Notes
		4 : 10 : 21 : 7	P1	for process of using "twice", e.g. $\frac{3}{4} \times 2x$ or $\frac{1}{4} \times 2x$ or $(2 + 5) \times 2$
			P1	for combining ratios e.g. $\frac{2}{7}x : \frac{5}{7}x : \frac{3}{4} \times 2x : \frac{1}{4} \times 2x$ or correct but unsimplified ratio leading to given ratio
			A1	cao

Q12.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	Explanation	C1	For stating the LCM of (4+7) and (5+3) is 88 **or** there is no smaller multiple of 8 and 11 (than 88)	
(b)	23	P1	for using a scale factor appropriately eg 4 × 8 (=32) **or** 3 × 11 (=33) **or** 7 × 8 (=56) **or** 5 × 11 (=55) **or** for writing a pair of suitable fractions, eg $\frac{7}{11}$ and $\frac{3}{8}$ **or** $\frac{4}{11}$ and $\frac{5}{8}$ **or** $\frac{3}{8}$ and $\frac{4}{11}$	May be seen in a two-way table or probability tree
		P1	for finding the number of large cubes and red cubes **or** small and yellow **or** small and red eg 7 × 8 (=56) and 3 × 11 (=33) **or** 4 × 8 (=32) and 5 × 11 (=55) **or** 4 × 8 (=32) and 3 × 11 (=33) **OR** a suitable fractional equation, eg $\frac{7}{11} - x = \frac{3}{8}$ **or** $\frac{5}{8} - x = \frac{4}{11}$ **or** $x = 1 - \frac{3}{8} - \frac{4}{11}$ **OR** a suitable pair of probabilities with a common denominator, eg $\frac{56}{88}$ and $\frac{33}{88}$ **or** $\frac{32}{88}$ and $\frac{55}{88}$ **or** $\frac{33}{88}$ and $\frac{32}{88}$	May be seen in a two-way table or probability tree $\frac{23}{88}$ scores P2A0
		A1	cao	

Q13.

Question	Answer	Mark	Mark scheme	Additional guidance
	18	P1	for 240 ÷ 10 (= 24) **or** 240 ÷ 8 (= 30)	Accept 3 + 7 for 10, 3 + 5 for 8
		P1	for 3 × "24" (= 72) **or** 7 × "24" (= 168) **or** 3 × "30" (= 90) **or** 5 × "30" (= 150)	
		P1	for 3 × "24" (= 72) **and** 3 × "30" (= 90) **or** 7 × "24" (= 168) **and** 5 × "30" (= 150)	
		A1	Cao	

Q14.

Question	Working	Answer	Mark	Notes
		$y=\frac{x(k+1)}{k-1}$	M1	$y+x=k(y-x)$ **or** $\frac{y+x}{y-x}=k$ oe
	$ky-y=x+kx$ $y(k-1)=x(1+k)$		M1	For isolating x and y on opposite sides eg $ky-y=x+kx$
			A1	Completing correct algebraic reasoning to reach conclusion

Q15.

Paper_5MB1H_01				
Question	Working	Answer	Mark	Notes
		28	5	M1 for method to find $\frac{1}{5}$ of children eg 60 ÷ 5 (=12) M1 for method to find number of boys or girls eg "12" × 2 (=24) or "12"×3 (=36) M1 for method to find total number going in the morning eg $\frac{3}{4}\times 60$ (= 45) M1 for complete method to find number of girls going in the morning eg 45 – (24 - 7) A1 cao

Q16.

Paper 1MA1: 2H			
Question	Working	Answer	Notes
		96	P1 a strategy to start to solve the problem eg. $18 \div (7 - 4)$ (= 6) P1 for completing the process of solution eg. "6" × (4 + 5 + 7) A1 cao

Q17.

Paper 1MA1: 1H			
Question	Working	Answer	Notes
		Given result	M1 For length scale factor eg $\sqrt{\frac{4}{9}}$ **or** 120 : 405 M1 $\left(\sqrt{\frac{4}{9}}\right)^3 \times 405$ **or** $2^3 : 3^3$ (from 120 : 405) A1 120 from correct arithmetic **or** conclusion relating $2^3 : 3^3$ with $2^2 : 3^2$ with correct working

Q18.

Question	Working	Answer	Mark	Notes
4		15	P1 P1 A1	strategy to start the problem, eg 8 : 20 and 20 : 5 process to solve the problem, eg $\frac{5}{33} \times 100$ or 24 : 60 : 15 cao

Q19.

Question	Working	Answer	Mark	Notes
		3 : 4 : 11	P1 P1 A1	Makes a start e.g. by using multipliers e.g. $1 + 5 = 6$ and $7 + 11 = 18$ and $6 \times 3 = 18$ or $AB:BD = 3:15$ or $x=3y$ (appropriate x and y shown) or $\frac{1}{6} = \frac{3}{18}$ Complete process to find ratios e.g. $(7 + 11) \div (1 + 5) = 3$ and $1 \times$ "3" : $7 -$ ("3" $\times 1$) : 11 oe

Q20.

Question		Working	Answer	Mark	Notes
			36.4	4	P1 a strategy to start to solve the problem e.g. $105 \div (5 - 2)$ (= 35) P1 process to find Laura's share e.g. $385 - 2 \times$ "35" $- 5 \times$ "35" (= 140) or $385 \div$ "35" $- 2 - 5$ (= 4) P1 process to find the percentage Laura gets e.g. "140" $\div 385 \times 100$ oe or "4" $\div 11 \times 100$ oe A1 answer in range 36.3 to 36.4, accept 36%

Q21.

Question	Working	Answer	Mark	Notes
		1:3	M1 M1 A1	for a valid first step, e.g. $\sqrt{9 \times 7} + \sqrt{9c}$ for a complete method to show a multiplicative relationship, e.g. $3\left(\sqrt{7} + \sqrt{c}\right)$ cao

Q22.

Question	Working	Answer	Mark	Notes
		$\frac{1}{3}$	P1	process to solve the problem e.g. $\frac{3}{10}\times\frac{4}{9}(=\frac{12}{90}=\frac{2}{15})$ OR finds the number of white circles for their chosen number OR for 9 : 21 (or a multiple of 9 : 21)
			P1	second step of the process e.g. $\frac{7}{10}\times\frac{2}{7}(=\frac{14}{70}=\frac{2}{10}=\frac{1}{5})$ OR finds the number of black circles for their chosen number OR for a multiple of 2 : 5 where the ratio parts sum to "21"
			P1	for complete process e.g. $"\frac{2}{15}"+"\frac{1}{5}"\left(=\frac{4}{30}+\frac{6}{30}\right)$ OR finds the total number of circles for their chosen number OR for 3 ratios that could be used to solve the problem eg 9 : 21 with 4 : 5 with 6 : 15
			A1	for $\frac{1}{3}$ oe

Q23.

Paper 1MA1: 1H			
Question	Working	Answer	Notes
		25	P1 For process to start to solve. Eg. use of x and $4x$ or $x/5x$ and $4x/5x$
			P1 process to form equation, eg. $\frac{x}{5x}\times\frac{x-1}{5x-1}=\frac{6}{155}$
			P1 Processes to eliminate fractions and reduce equation to linear form eg. $155x - 155 = 150x - 30$
			A1

Q24.

Question		Working	Answer	Mark	Notes
			$y = -4x + 5$	5	P1 for appropriate process to find gradient e.g. $\frac{12-7}{11--9}$ $(=\frac{1}{4})$ P1 process to find y coordinate $7 + \frac{2}{5} \times 5$ $(= 9)$ or x coordinate $-9 + \frac{2}{5} \times 20$ $(= -1)$ P1 method to find gradient of line L $\frac{-1}{\frac{1}{4}}$ $(= -4)$ M1 substitution of found values for x, y and m into equation for straight line A1 $y = -4x + 5$

Q25.

Question	Working	Answer	Notes
	$\frac{2x-1}{x-4} = \frac{16x+1}{2x-1}$ $(2x-1)^2 = (16x+1)(x-4)$ $12x^2 - 59x - 5 = 0$ $(12x+1)(x-5) = 0$	$-\frac{1}{12}$, 5	P1 for process to write as an equation P1 for process to clear the fractions P1 for process to write equation in form $ax^2 + bx + c = 0$ P1 for process to solve the equation A1 cao