



Turn over

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Advice

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets – use this as a guide as to how much time to spend on each question.

Information

- **Calculators may not be used.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working.**
- – there may be more space than you need.
- Answer the questions in the spaces provided
- Answer **all** questions.
- centre number and candidate number.
- **Fill in the boxes** at the top of this page with your name,
- Use **black** ink or ball-point pen.



Instructions

Please check the examination details below before entering your candidate information

Candidate surname KTH		Other names MS	
Centre Number		Candidate Number	
Tuesday 21 May 2019			
Morning (Time: 1 hour 30 minutes)		Paper Reference 1MA1/1H	
Mathematics			
Paper 1 (Non-Calculator)			
Higher Tier			
<p>You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.</p> <p>Total Marks</p>			
Tracing paper may be used.			



ND064498634



(Total for Question 1 is 4 marks)

(2)

60

Blue $20\% = 12 \text{ cubes} \therefore 10\% = 6 \text{ cubes}$

Red $40\% = 24 \text{ cubes}$

Yellow $40\% = 24 \text{ cubes} +$

$$\frac{60}{1}$$

(b) Work out the total number of cubes in the box.
 There are 12 blue cubes in the box.

(2)

$$1 - 0.2 = 0.8$$

$$0.8 \div 2 = 0.4$$

(a) Complete the table.
 The number of red cubes in the box is the same as the number of yellow cubes in the box.

Colour	blue	red	yellow
Probability	0.2	0.4	0.4

1 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.

You must write down all the stages in your working.

Write your answers in the spaces provided.

Answer ALL questions.

MCS 125

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2 Deon needs 50 g of sugar to make 15 biscuits.

She also needs

three times as much flour as sugar
two times as much butter as sugar

Deon is going to make 60 biscuits.

(a) Work out the amount of flour she needs.

Sugar : flour : Butter
 x : $3x$: $2x$
 50g : 150g : 100g
15 biscuits
 $\times 4$
60 biscuits
 200g : 600g : 400g

Deon has to buy all the butter she needs to make 60 biscuits.
She buys the butter in 250 g packs.

(b) How many packs of butter does Deon need to buy?

Deon needs 400g butter

Pack : Butter
 1 : 250g
 2 : 500g

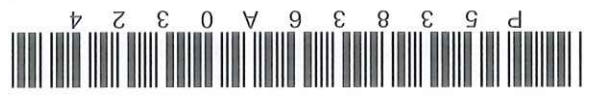
(Total for Question 2 is 5 marks)

(2)
2

(3)

600g

MW 39



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3 Find the highest common factor (HCF) of 72 and 90

mw 79

Factors of 72

- 1 x 72
- 2 x 36
- 3 x 24
- 4 x 18
- 6 x 12
- 8 x 9

- 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72

Factors of 90

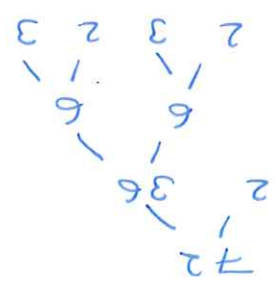
- 1 x 90
- 2 x 45
- 3 x 30
- 5 x 18
- 9 x 10

- 1, 2, 3, 5, 9, 10, 18, 30, 45, 90

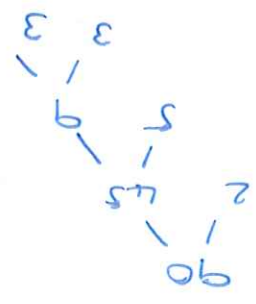
18

(Total for Question 3 is 2 marks)

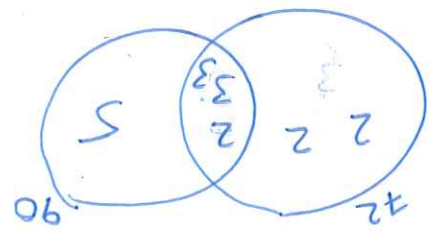
OR



$$72 = 2 \times 2 \times 2 \times 3 \times 3$$

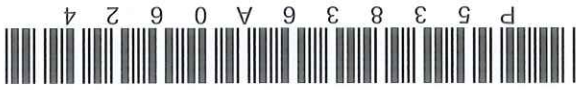


$$90 = 2 \times 3 \times 3 \times 5$$



$$\text{HCF} = 2 \times 3 \times 3 = 18$$

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(Total for Question 5 is 3 marks)

$d = 1$

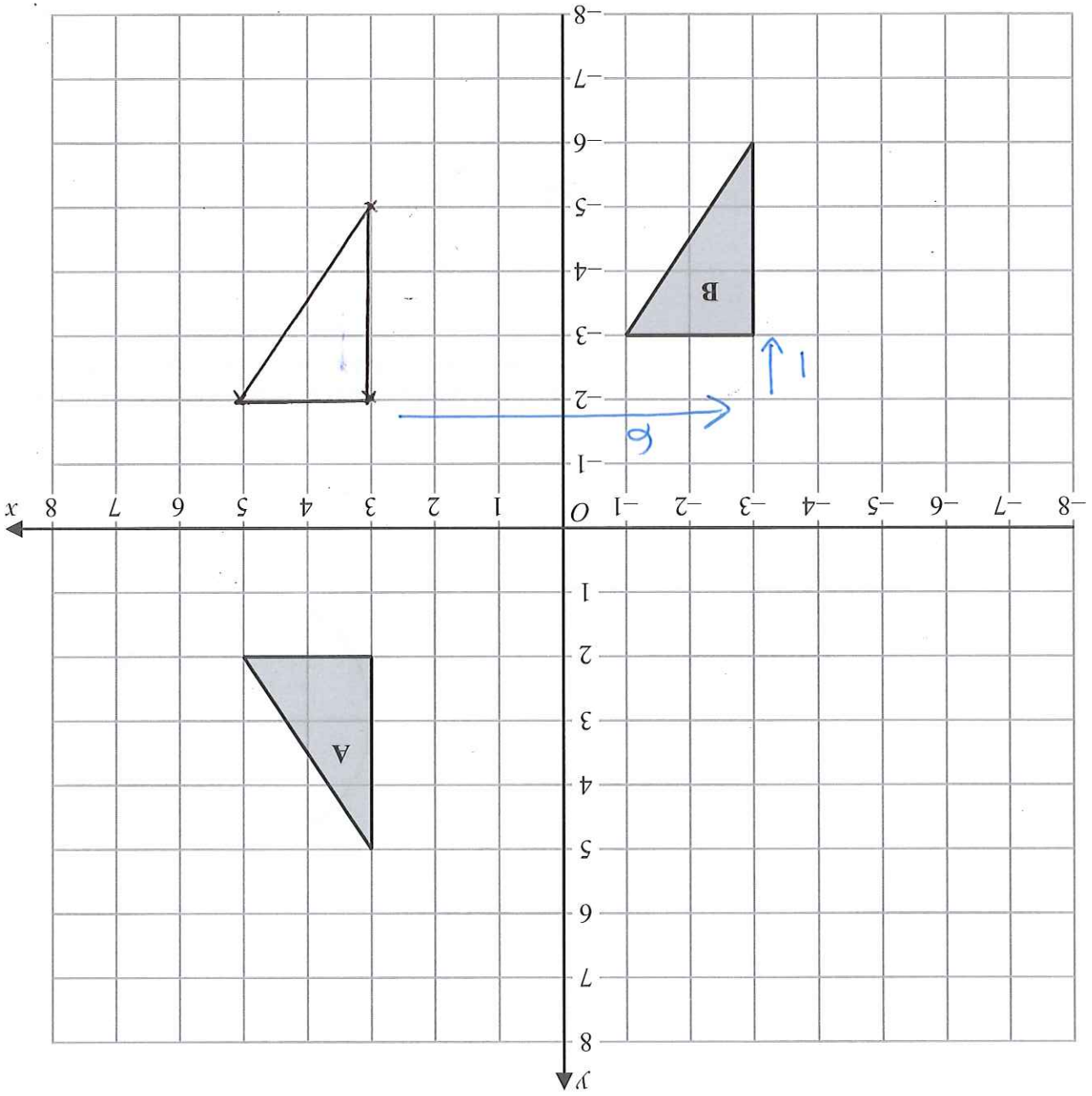
$c = 6$

MW 48, 50

Find the value of c and the value of d .

$$\text{translation} \begin{pmatrix} c \\ d \end{pmatrix}$$

Shape A can be transformed to shape B by a reflection in the x -axis followed by a



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6 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,

number of packs of black pens sold : 7
number of packs of red pens sold : 3
number of packs of green pens sold : 4
= 7:3:4

A total of 212 pens were sold.

Work out the number of green pens sold.

56	:	60	:	96	:	212 pens
x2		x2		x2		x2
28	:	30	:	48	:	106 pens
x2		x2		x2		x2
14	:	15	:	24	:	53 pens
x2		x5		x6		
Black pens		Red pens		Green pens		

$$\begin{array}{r} 1 \\ \hline 53 \\ + 24 \\ + 15 \\ \hline 96 \end{array}$$

96
A1

(Total for Question 6 is 4 marks)



P 5 3 8 3 6 A 0 7 2 4

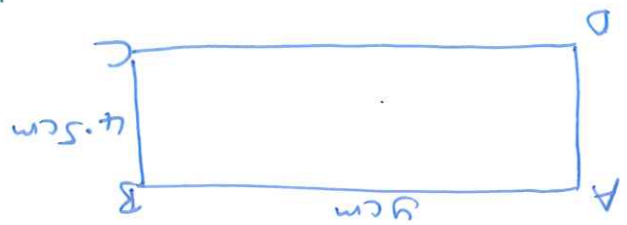


(Total for Question 7 is 4 marks)

..... cm

$\times 1$
8.5

Perimeter ABCD = 26
 $2y + 2y + 2(4.5) = 26$
 $4y + 9 = 26$
 $4y = 17$
 $y = 4.25$



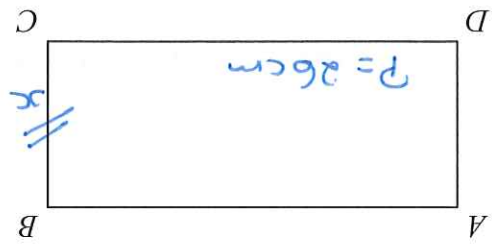
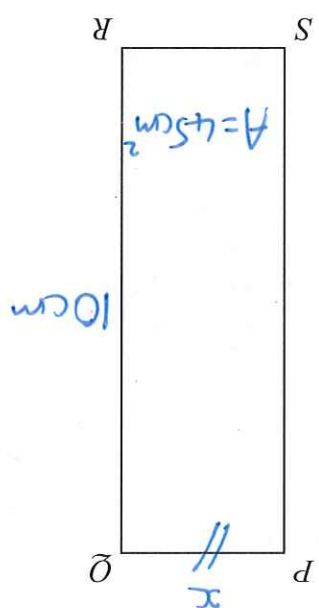
Let $AB = DC = y$

Let $BC = PQ = x$
 Area PQRS = $10x$
 $\therefore 10x = 45$
 $x = 4.5$ cm

Find the length of AB.

The perimeter of ABCD is 26 cm
 The area of PQRS is 45 cm²

$QR = 10$ cm
 $BC = PQ$



7 Here are two rectangles.

MW 137

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8 (a) Work out an estimate for the value of $\sqrt{63.5 \times 101.7}$

look for square numbers close to 63.5 and 101.7

$$\begin{aligned}
 &= \sqrt{64 \times 100} \\
 &= \sqrt{64} \times \sqrt{100} \\
 &= 8 \times 10 \\
 &= 80
 \end{aligned}$$

MW 91

(2.3)⁶ = 148 correct to 3 significant figures.

(b) Find the value of (0.23)⁶ correct to 3 significant figures.

$$0.23 = \frac{23}{100}$$

$$\begin{aligned}
 &= \frac{2.3^6}{10^6} = \frac{148}{1000000} \\
 &= 0.000148
 \end{aligned}$$

$$0.000148$$

(c) Find the value of 5⁻²

MW 154

(Total for Question 8 is 4 marks)

(1)

$$\frac{1}{25}$$

(1)

$$0.000148$$

(2)

$$75-81$$



P 5 3 8 3 6 A 0 9 2 4



P 5 3 8 3 6 3 A 0 1 0 2 4

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(Total for Question 9 is 3 marks)

$\frac{5}{5}$

$$= \frac{2}{5} \times \frac{5}{1}$$

$$= \frac{56}{10}$$

$$= \frac{5}{6}$$

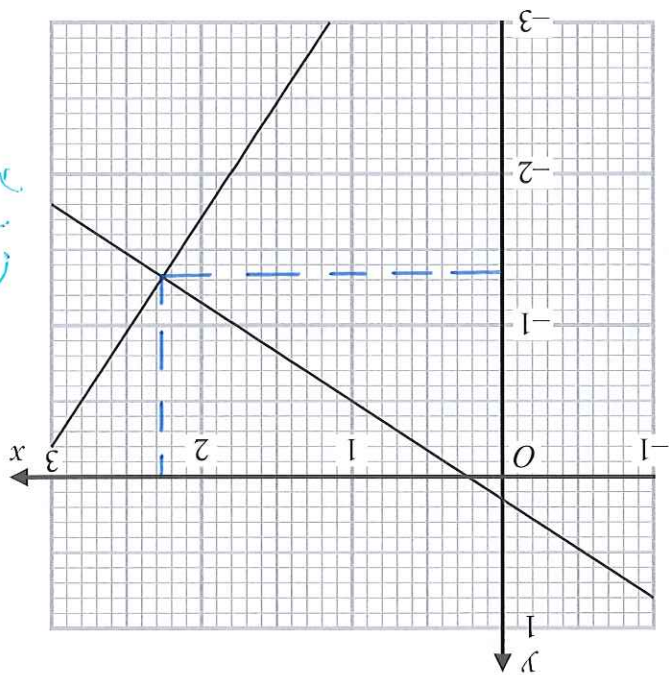
$$= 5\frac{2}{3}$$

Give your answer as a mixed number in its simplest form.

9 Work out $3\frac{1}{2} \times 1\frac{1}{5}$

MW 73

10 The graphs with equations $3y + 2x = \frac{1}{2}$ and $2y - 3x = -\frac{113}{12}$ have been drawn on the grid below.



Using the graphs, find estimates of the solutions of the simultaneous equations

$$3y + 2x = \frac{1}{2}$$

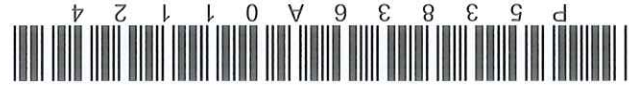
$$2y - 3x = -\frac{113}{12}$$

$x = 2.25$ $y = -1.35$

M1

both

(Total for Question 10 is 2 marks)



MW 140



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Mae 187

11 A bus company recorded the ages, in years, of the people on coach A and the people on coach B.

Here are the ages of the 23 people on coach A.

- 60
- 61
- 63
- 64
- 64
- 66
- 67
- 69
- 74
- 77
- 79
- 41
- 42
- 44
- 48
- 52
- 53
- 53
- 56
- 57
- 57
- 59

$\frac{23+1}{2} = 12$ Median 12th numbr

M

LQ
UQ

(a) Complete the table below to show information about the ages of the people on coach A.

Median	59
Lower quartile	53
Upper quartile	66
Least age	41
Greatest age	79

$B1 = 38$
 $B1 = 79 - 41$
 $IQR = 66 - 53$
 $= 13$

Here is some information about the ages of the people on coach B.

Median	70
Lower quartile	54
Upper quartile	73
Least age	42
Greatest age	85

$Range = 85 - 42 = 43$
 $IQR = 73 - 54 = 19$

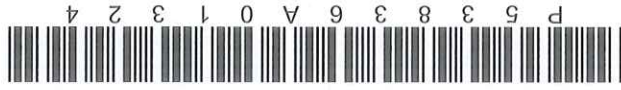
Richard says that the people on coach A are younger than the people on coach B.

(b) Is Richard correct?

You must give a reason for your answer.

Yes. The median age of people on coach A is younger (59) than the median age of people on coach B (70)
 Comment must compare medians

(1)

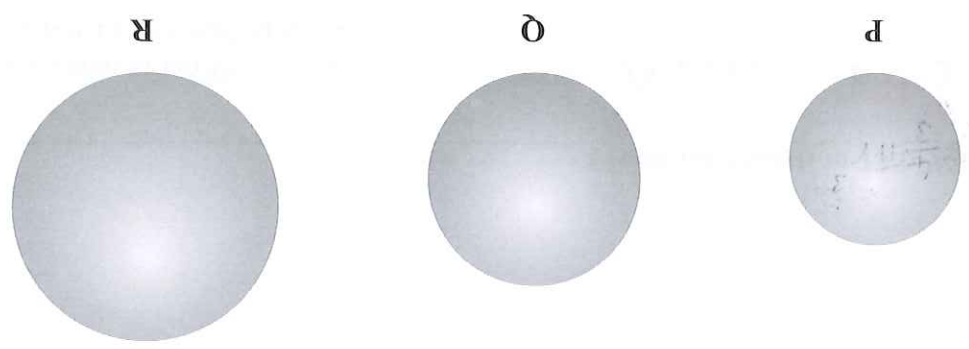


(Total for Question 12 is 3 marks)

$$\frac{\text{Volume P}}{\text{Volume R}} = \frac{100}{225} = \frac{4}{9} \text{ A1}$$

Let Volume of Sphere P be 100 cm^3
 The Volume of Sphere Q is 150 cm^3
 and Volume of Sphere R is 225 cm^3

The volume of sphere Q is 50% more than the volume of sphere P.
 The volume of sphere R is 50% more than the volume of sphere Q.
 Find the volume of sphere P as a fraction of the volume of sphere R.



12 Here are three spheres.

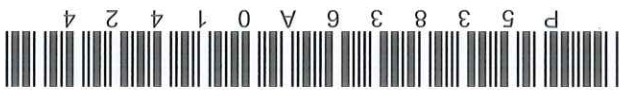
(Total for Question 11 is 4 marks)

(1)

No. The range of ages is greater on coach B
 No. The IQR of ages is greater on coach B

(c) Is Richard correct?
 You must give a reason for your answer.

Richard says that the people on coach A vary more in age than the people on coach B.



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(Total for Question 14 is 2 marks)

2/1 A1

now rationalise the denominator

$$\frac{\sqrt{3}}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{6}{3}$$

$$= \frac{\sqrt{3}}{2\sqrt{3}}$$

$$= \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{2}$$

$$\tan 30^\circ \times \sin 60^\circ$$

$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$

Give your answer in its simplest form.

14 Find the exact value of $\tan 30^\circ \times \sin 60^\circ$

MW 173

(Total for Question 13 is 2 marks)

if n is odd let n be 2n+1

$$\begin{aligned} &(2n+1)^2 - (2n+1) \\ &= (2n+1)(2n+1) - (2n+1) \\ &= 4n^2 + 4n + 1 - 2n - 1 \\ &= 4n^2 + 2n \\ &= 2n(2n+1) \end{aligned}$$

∴ even
multiple of 2

if n is even let n be 2n

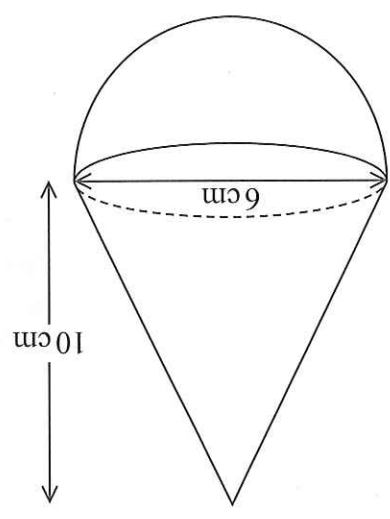
$$\begin{aligned} &(2n)^2 - 2n \\ &= 4n^2 - 2n \\ &= 2n(2n-1) \end{aligned}$$

∴ even
multiple of 2

13 Given that n can be any integer such that n > 1, prove that n² - n is never an odd number.

MW 193

15 The diagram shows a solid shape. The shape is a cone on top of a hemisphere.



The height of the cone is 10 cm.
The base of the cone has a diameter of 6 cm.
The hemisphere has a diameter of 6 cm.

The total volume of the shape is $k\pi \text{ cm}^3$, where k is an integer.

Work out the value of k .

Volume = Volume Cone + Volume hemisphere

$$= \frac{1}{3} \pi r^2 h + \frac{2}{1} \times \frac{3}{4} \pi r^3$$

$$= \frac{1}{3} \pi (3)^2 (10) + \frac{6}{4} \pi (3)^3$$

$$= \frac{3}{1} \pi (90) + \frac{4}{1} \pi (27)$$

$$= 30\pi + 18\pi$$

$$= 48\pi$$

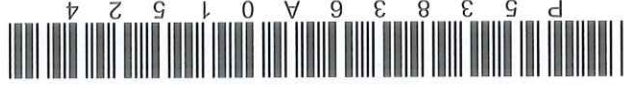
$k = 48$
AI CAO

(Total for Question 15 is 4 marks)

Volume of a sphere = $\frac{4}{3} \pi r^3$

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

MW 171, 172

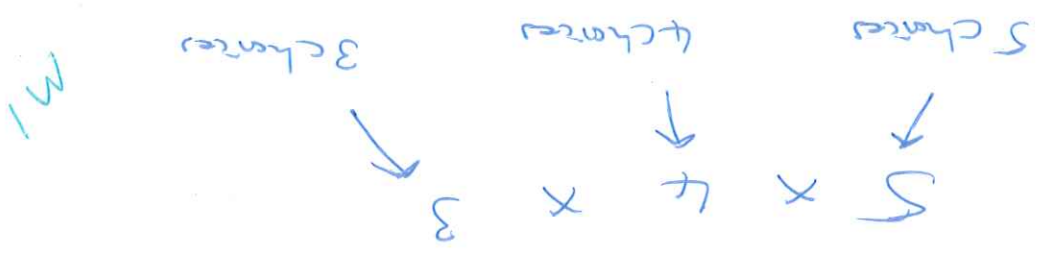


P 5 3 8 3 6 A 0 1 5 2 4

(Total for Question 16 is 4 marks)

(2)

60 A1



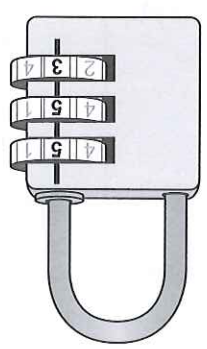
(b) How many of the possible three digit numbers have three different digits?

(2)

125 A1



(a) Work out the number of different three digit numbers that can be set for the combination lock.



16 There are three dials on a combination lock. Each dial can be set to one of the numbers 1, 2, 3, 4, 5. The three digit number 553 is one way the dials can be set, as shown in the diagram.

try new 69

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17 Given that

Find the possible values of x .

$$x^2 : (3x + 5) = 1 : 2$$

$$x^2 : 3x + 5 = 1 : 2$$

$$\frac{x^2}{3x+5} = \frac{1}{2}$$

$$2x^2 = 3x + 5$$

$$2x^2 - 3x - 5 = 0$$

$$(2x - 5)(x + 1) = 0$$

$$2x - 5 = 0 \quad \text{or} \quad x + 1 = 0$$

$$2x = 5$$

$$x = \frac{5}{2}$$

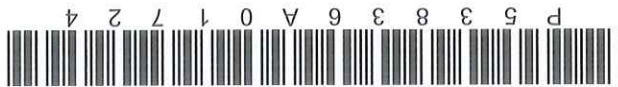
either

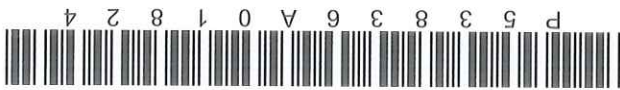
$$2x - 5x = -3x$$

$$(2x - 5)(x + 1)$$

$$\frac{2}{5}, -1$$

(Total for Question 17 is 4 marks)





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(Total for Question 18 is 5 marks)

(3)

Ans $\frac{\sqrt{3}}{81}$

$$= \frac{\sqrt{3}}{27 \times 3} = \frac{\sqrt{3}}{81}$$

M1 $\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$

$(\sqrt{3})^7 = \sqrt{3} \sqrt{3} \sqrt{3} \sqrt{3} \sqrt{3} \sqrt{3} \sqrt{3}$
 $= 27\sqrt{3}$

$\frac{1}{2} \times 7 = 3 \frac{1}{2} = \frac{7}{2}$

Rationalize denominator

$$= \frac{1}{27\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{(\sqrt{3})^{\frac{7}{2}}}{1}$$

$$= \frac{3^{\frac{7}{2}}}{1}$$

$$= \frac{(3^{\frac{1}{2}})^7}{1}$$

$$= \frac{(\sqrt{3})^7}{1}$$

(b) Express $\left(\frac{1}{\sqrt{3}}\right)^7$ in the form $\frac{a\sqrt{b}}{c}$ where b and c are integers.

(2)

Ans $3\sqrt{3}$

Ans

$$= 3\sqrt{3}$$

$$= \sqrt{3} + 2\sqrt{3}$$

$$\therefore \sqrt{3} + \sqrt{12}$$

$$\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$$

(a) Express $\sqrt{3} + \sqrt{12}$ in the form $a\sqrt{3}$ where a is an integer.

MW 207



(Total for Question 19 is 3 marks)

(1)

(3, -8) B1

MW 160

right 3
down 8

(ii) Hence write down the coordinates of the turning point on the graph of $y = x^2 - 6x + 1$

(2)

a = 3
b = 8 A1

$$= (x-3)^2 - 9 + 1$$

$$= (x-3)^2 - 8$$

M1

(i) find the value of a and the value of b.

19 Given that $x^2 - 6x + 1 = (x - a)^2 - b$ for all values of x,

MW 209



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20 h is inversely proportional to p
 p is directly proportional to \sqrt{t}

Given that $h = 10$ and $t = 144$ when $p = 6$
 find a formula for h in terms of t

mw 199

$$h \propto \frac{1}{p} \quad p \propto \sqrt{t}$$

$$h = \frac{p}{x}$$

$$10 = \frac{6}{x} \quad p$$

$$60 = x$$

$$\therefore h = \frac{60}{p}$$

$$p = k\sqrt{t}$$

$$6 = k\sqrt{144}$$

$$6 = 12k$$

$$\frac{6}{12} = k$$

$$\frac{1}{2} = k$$

$$\therefore p = \frac{1}{2}\sqrt{t}$$

$$h = \frac{60}{\frac{1}{2}\sqrt{t}}$$

$$h = \frac{120}{\sqrt{t}}$$

this ok for
 find AI

$$h = \frac{120\sqrt{t}}{t}$$

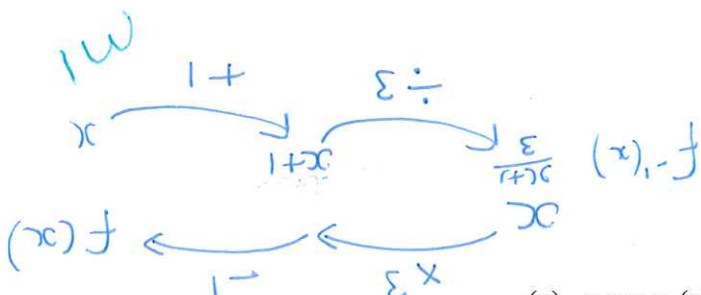
$$h = \frac{120\sqrt{t}}{t}$$

(Total for Question 20 is 4 marks)

21 The functions f and g are such that

$f(x) = 3x - 1$ and $g(x) = x^2 + 4$

(a) Find $f^{-1}(x)$



MW 214

Given that $fg(x) = 2gf(x)$, show that $15x^2 - 12x - 1 = 0$

MW 215

$$\begin{aligned}
 f[g(x)] &= f(x^2 + 4) \\
 &= 3(x^2 + 4) - 1 \\
 &= 3x^2 + 12 - 1 \\
 &= 3x^2 + 11
 \end{aligned}$$

$$\begin{aligned}
 2g[f(x)] &= 2g(3x - 1) \\
 &= 2[(3x - 1)^2 + 4] \\
 &= 2[9x^2 - 6x + 1 + 4] \\
 &= 2[9x^2 - 6x + 5] \\
 &= 18x^2 - 12x + 10
 \end{aligned}$$

$M1 \quad fg(x) = 2gf(x)$

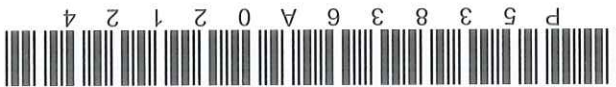
$$\begin{aligned}
 3x^2 + 11 &= 18x^2 - 12x + 10 \\
 11 &= 15x^2 - 12x + 10 \\
 0 &= 15x^2 - 12x - 1
 \end{aligned}$$

$$\begin{aligned}
 &[-3x^2 \\
 &[-11] \\
 &C1
 \end{aligned}$$

(2) $f^{-1}(x) = \frac{x+1}{3}$

(5)

(Total for Question 21 is 7 marks)





(Total for Question 22 is 5 marks)

22 There are only r red counters and g green counters in a bag.

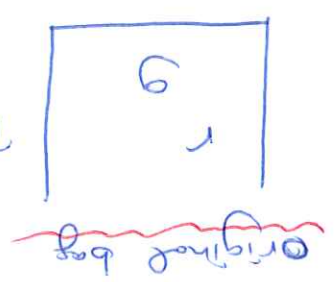
A counter is taken at random from the bag.
The probability that the counter is green is $\frac{3}{7}$

The counter is put back in the bag.

2 more red counters and 3 more green counters are put in the bag.

A counter is taken at random from the bag.
The probability that the counter is green is $\frac{13}{6}$

Find the number of red counters and the number of green counters that were in the bag originally.



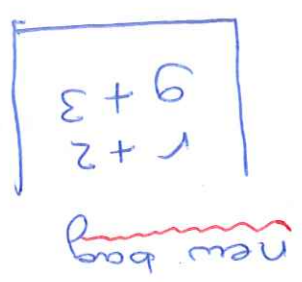
$$P(g) = \frac{g}{r+g} = \frac{4}{13}$$

$$rg = 3(r+g)$$

$$rg = 3r + 3g$$

$$4g = 3r$$

$$r = \frac{4g}{3}$$



$$P(g) = \frac{g+3}{r+2+g+3} = \frac{6}{13}$$

$$13(g+3) = 6(r+g+5)$$

$$13g + 39 = 6r + 6g + 30$$

$$7g - 6r = -9$$

$$7g - 6\left(\frac{4g}{3}\right) = -9$$

$$7g - \frac{24g}{3} = -9$$

$$7g - 8g = -9$$

red counters

12

green counters

9

$$r = \frac{4 \times 9}{3}$$

$$r = 12$$

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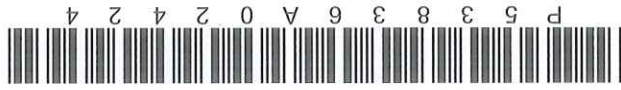
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