WORKED SOLUTIONS

April Practice Paper No. 9

Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number

Candidate Number

Mathematics

Paper 3 (Calculator)

Higher Tier

Sample Assessment Materials – Issue 2

Paper Reference
1MA1/3H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – there may be more space than you need.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- 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.

My Mark: ....

My target for the actual GCSE: ....

Action to help me reach my target:

(e.g. MW clips you will take notes on)

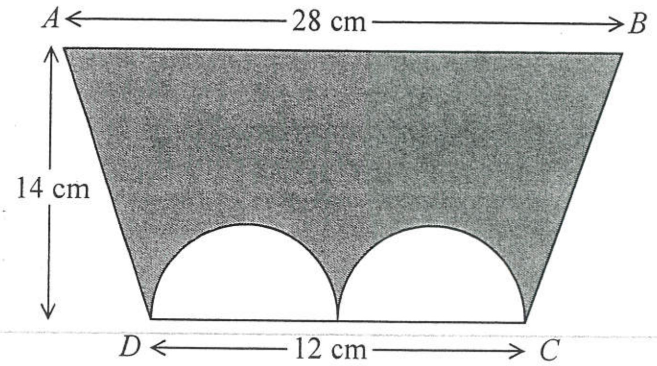
Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

MW
117

1 The diagram shows a trapezium *ABCD* and two identical semicircles.



The centre of each semicircle is on *DC*.

Work out the area of the shaded region.
Give your answer correct to 3 significant figures.

Area of trapezium $= \frac{1}{2}(a+b) \times h$

M1 OR $= \frac{1}{2} \times (28+12) \times 14$

$= 280 \text{ cm}^2$

Area of circle $= \pi \times r^2$ $r = 3$ cm P1

$= \pi \times 3^2$

[two semicircles] $= 28.27 \text{ cm}^2$

shaded area $= 280 - 28.27 = 251.725...$

A1 252 cm²

(Total for Question 1 is 4 marks)

for A1 allow 251.7 → 252
[ie do not have to round to 3 sig figs
but 251 loses accuracy mark)

DO NOT WRITE IN THIS AREA

MW 105

2 Asif is going on holiday to Turkey.

The exchange rate is £1 = 3.5601 lira.

Asif changes £550 to lira.

(a) Work out how many lira he should get.
Give your answer to the nearest lira.

3.5601×550 M1

$= 1958.055$

A1

1958 lira

(2)

Asif sees a pair of shoes in Turkey.
The shoes cost 210 lira.

Asif does not have a calculator.
He uses £2 = 7 lira to work out the approximate cost of the shoes in pounds.

(b) Use £2 = 7 lira to show that the approximate cost of the shoes is £60

£2 = 7 lira

×30

£60 ≈ 210 lira

$210 \div 7 = 30$ M1

$£2 \times 30 = £60.$ C1 ⇒ must show correct calculation.

(2)

(c) Is using £2 = 7 lira instead of using £1 = 3.5601 lira a sensible start to Asif's method to work out the cost of the shoes in pounds?

You must give a reason for your answer.

Yes, because 3.5601 is approximately 3.5 = 3½ and if we double this we get 7 lira, and 7 divides into 210.

C1

(1)

(Total for Question 2 is 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

3 Here are the first six terms of a Fibonacci sequence.

MW
141

1 1 2 3 5 8

The rule to continue a Fibonacci sequence is,

the next term in the sequence is the sum of the two previous terms.

(a) Find the 9th term of this sequence.

7th term = 13
8th term = 21

B1

~~8~~34
(1)
cao

The first three terms of a different Fibonacci sequence are

$a \quad b \quad a+b$

(b) Show that the 6th term of this sequence is $3a + 5b$

4th term = (a+b)+b = a+2b
5th term = (a+2b)+(a+b) = 2a+3b
6th term = (2a+3b)+(a+2b) = 3a+5b

M1

(2)

C1 ⇒ workings must be shown.

Given that the 3rd term is 7 and the 6th term is 29,

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

P1 ⇒ set up two equations

a + b = 7 (1) ×3
3a + 5b = 29 (2)
3a + 3b = 21 (3)

(2) − (3) 2b = 8 b = 4.

P1 ⇒ to solve sim. eqns.

in (1) a+b = 7 a = 3.

check in (2) ~~12+~~ 9 + 20 = 29 ✓

a=3, b=4
(3)

A1

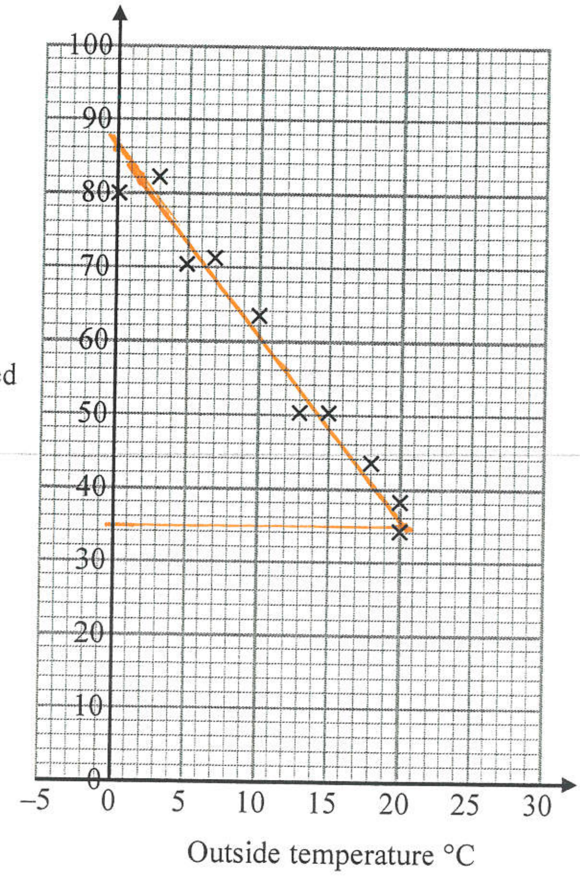
(Total for Question 3 is 6 marks)

must have both correct.

MW
129

4 In a survey, the outside temperature and the number of units of electricity used for heating were recorded for ten homes.

The scatter diagram shows this information.



M1 line of best fit

always draw this for an easy method mark.

Molly says,

"On average the number of units of electricity used for heating decreases by 4 units for each °C increase in outside temperature."

(a) Is Molly right?
Show how you get your answer.

M1 gradient

Gradient of line of best fit $= -\frac{50}{20} = -2.5$

She is wrong; it decreases by $2\frac{1}{2}$°C for each °C increase.

C1 gradient $\pm 2 \to 3$ & "NO".

(3)

(b) You should **not** use a line of best fit to predict the number of units of electricity used for heating when the outside temperature is 30 °C.

Give one reason why.

The last crosses are at 20°C, so our line of best fit is only valid for 0 → 20°C. C1

(1)

(Total for Question 4 is 4 marks)

MW 22b

5 Henry is thinking of having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter	No Water Meter
A charge of £28.20 per year **plus** 91.22p for every cubic metre of water used 1 cubic metre = 1000 litres	A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Use this information to determine whether or not Henry should have a water meter.

180 litres per day

P1 ×365 ⇒ 65700 litres per year

P1 ÷1000 ⇒ 65.7 cubic metres per year

×91.22p ⇒ 5993.154p per year

P1 ÷ 100 ⇒ £59.93 per year

+ standing charge of £28.20

⇒ £88.13 P1 ⇒ must have units "£"

This is £18.87 less than with no water meter A1

so Yes, Henry should have a water meter.

(Total for Question 5 is 5 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

MW 80

6 Liz buys packets of coloured buttons.

There are 8 red buttons in each packet of red buttons.
There are 6 silver buttons in each packet of silver buttons.
There are 5 gold buttons in each packet of gold buttons.

Liz buys equal numbers of red buttons, silver buttons and gold buttons.

How many packets of each colour of buttons did Liz buy?

Red: 8, 16, 24, 32, 40, ...
Silver: 6, 12, 18, 24, 30, 36, 42, ...
Gold: 5, 10, 15, 20, 25, ...

P1

OR

$8 \times 6 \times 5 = 240$

common factor of 2 $\quad 240 \div 2 = 120$ P1

120 is the LCM.

$120 \div 8 =$ 15 packets of red buttons

$120 \div 6 =$ 20 packets of silver buttons

$120 \div 5 =$ 24 packets of gold buttons

(Total for Question 6 is 3 marks)

A1 all 3 correct.

or any multiples of these groups

eg

eg	30	45	60
	40	60	80
	48	72	96

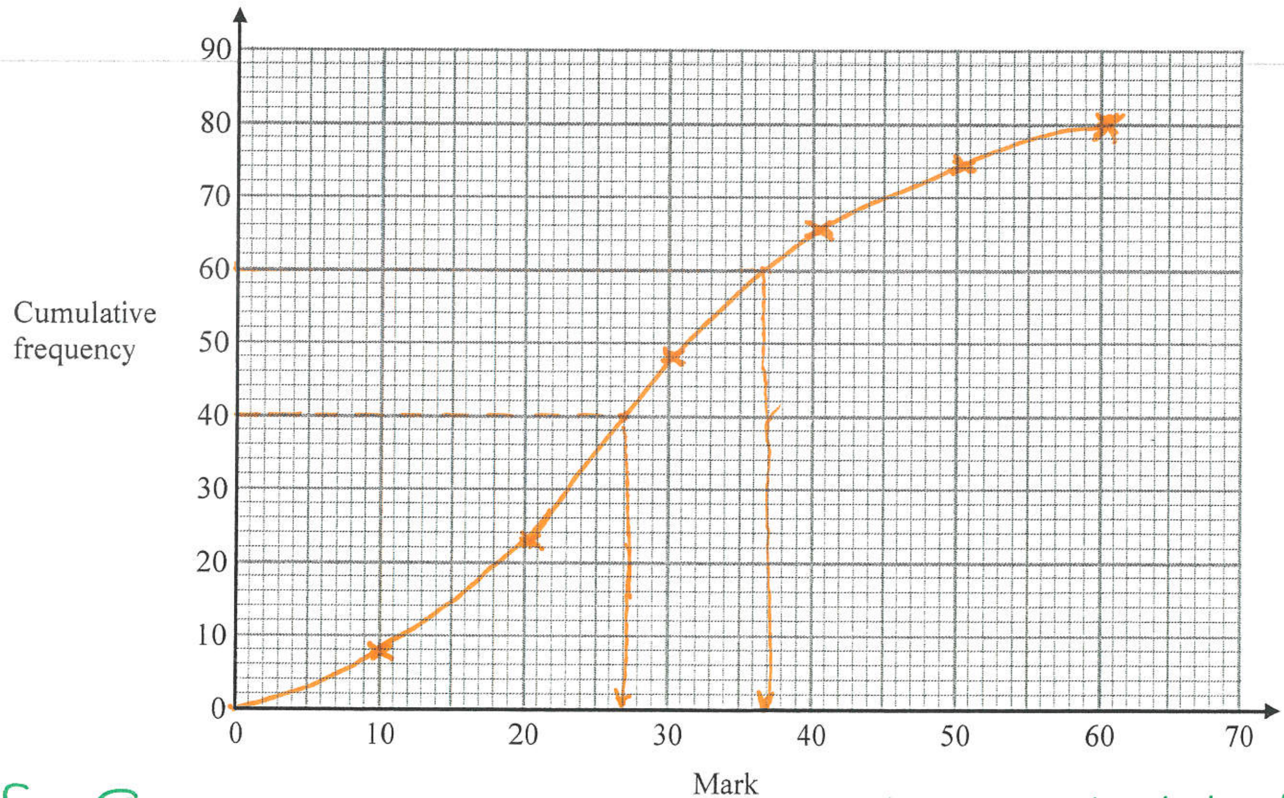
DO NOT WRITE IN THIS AREA

mw
186

7 The cumulative frequency table shows the marks some students got in a test.

Mark (m)	**Cumulative frequency**
$0 < m \leqslant 10$	8
$0 < m \leqslant 20$	23
$0 < m \leqslant 30$	48
$0 < m \leqslant 40$	65
$0 < m \leqslant 50$	74
$0 < m \leqslant 60$	80

(a) On the grid, plot a cumulative frequency graph for this information.



[SC-B1 if pts plotted consistently within interval, but not at end, & joined]

(2)

(b) Find the median mark.

M1 plotting 5 or 6 points correctly & joining

C1 correct graph all points joined by curve or straight line segments.

27 B1

(1)

A 25 → 28 inclusive

 Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Mathematics - Sample Assessment Materials (SAMs) - Issue 2 - June 2015

Students either pass the test or fail the test.
The pass mark is set so that 3 times as many students fail the test as pass the test.

(c) Find an estimate for the lowest possible pass mark.

$\frac{3}{4}$ fail $\frac{3}{4}$ of 80 = 60 students fail. P1

P1 Draw line from their "60" & read off. f.t.

(35 – 38) inclusive.   37 A1

(3)

(Total for Question 7 is 6 marks)

MW 83

8 Write 0.000068 in standard form.

B1 6.8×10^{-5}

(Total for Question 8 is 1 mark)

9 (a) Factorise $y^2 + 7y + 6$

MW 157

M1 $(y \pm 6)(y \pm 1)$

A1 $(y+6)(y+1)$

(2)

(b) Solve $6x + 4 > x + 17$

MW 139

$5x+4>17$

$5x>13$ M1 → or with = sign

$x>13/5$

$x > 2\,3/5$ A1

o.e. eg 2.6

(2)

(c) n is an integer with $-5 < 2n \leqslant 6$

Write down all the values of n

MW 138

$\div 2$ $\quad -2.5 < n \leq 3$ M1

A1 $-2, -1, 0, 1, 2, 3$

(2)

or listing the "evens" $-4, -2, 0, 2, 4, 6$

(Total for Question 9 is 6 marks)

---

10 The function f is such that

MW 214a

$$f(x) = 4x - 1$$

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

$y = 4x - 1$ M1

$y + 1 = 4x$

$\frac{y+1}{4} = x$

$f^{-1}(x) = \frac{x+1}{4}$ A1 o.e.

(2)

[eg $\frac{1}{4}x + \frac{1}{4}$]

The function g is such that

$$g(x) = kx^2 \text{ where } k \text{ is a constant.}$$

MW 215

Given that $fg(2) = 12$

(b) work out the value of k

$g(2) = k \times 4 = 4k$

P1 $fg(2) = 4 \times 4k - 1 = 16k - 1$

$16k - 1 = 12$

$16k = 13$

$k = 13/16$ A1

(2)

(Total for Question 10 is 4 marks)

11 Solve $x^2 - 5x + 3 = 0$

Give your solutions correct to 3 significant figures.

MW
191

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $a = 1$ $b = -5$ $c = 3$

$x = \frac{+5 \pm \sqrt{25 - 4 \times 1 \times 3}}{2}$ M1 substitute into the formula $\Rightarrow$ allow sign errors

$x = \frac{5 \pm \sqrt{13}}{2}$ M1

$x = 4.30$ or $x = 0.697.$ A1

(Total for Question 11 is 3 marks)

MW
127a

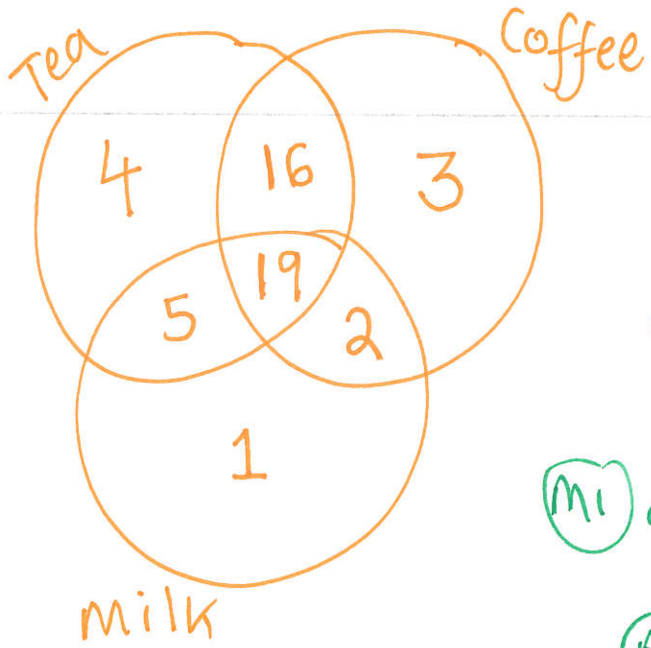
12 Sami asked 50 people which drinks they liked from tea, coffee and milk.

All 50 people like at least one of the drinks
19 people like all three drinks.
16 people like tea and coffee but do **not** like milk.
21 people like coffee and milk.
24 people like tea and milk.
40 people like coffee.
1 person likes only milk.

Sami selects at random one of the 50 people.

(a) Work out the probability that this person likes tea.

$40-(16+19+2)$



M1 3 overlapping regions with 19.

M1 at least 5 regions correct

M1 all regions correct

A1 $\frac{44}{50} = \frac{22}{25}$ or 0.88.

(4)

(b) Given that the person selected at random from the 50 people likes tea, find the probability that this person also likes exactly one other drink.

$16+5=21$

$4+16+5+19=44$

$\frac{21}{44}$. A1

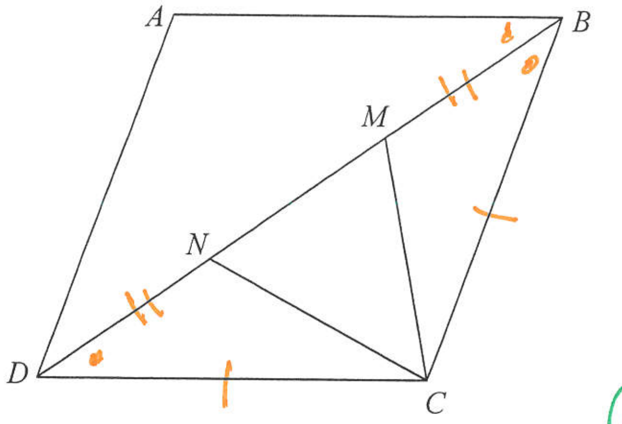
(2)

(Total for Question 12 is 6 marks)

P1 f.t. "16+5" and must ÷ "44"

13 *ABCD* is a rhombus.

MW166



C1 one correct relevant statement

C1 all correct relevant statement.

M and *N* are points on *BD* such that $DN = MB$.

Prove that triangle *DNC* is congruent to triangle *BMC*.

DC = CB because it is a rhombus, so all sides are equal in length

DN = MB (given)

DB is a line of symmetry of the rhombus so $A\hat{B}D = D\hat{B}C$

AB is parallel to DC (rhombus)

✗ so $A\hat{B}D = B\hat{D}C$ as alternate angles are equal

so $\triangle DNC \equiv \triangle BMC$ (s.a.s) C1

✗ must be given

(Total for Question 13 is 3 marks)

Reasons must be given.

✗ OR DB is a line of symmetry. $\triangle CBD$ is isosceles and base angles of an isosceles triangle are equal.

14 (a) Show that the equation $x^3 + 4x = 1$ has a solution between $x = 0$ and $x = 1$

When $x=0$ $\quad x^3+4x = 0 \;\boxed{<1}$ A1

When $x=1$ $\quad x^3+4x = 1+4 = 5 \;\boxed{>1}$

$0 \;\&\; 5 \Rightarrow$ M1

so $\quad 0 < x < 1$ M1

OR $f(x) = x^3+4x-1 \quad f(0) = -1 \quad f(1) = 4 \quad$ sign change, so a root as $f(x)$ is continuous. A1

(2)

(b) Show that the equation $x^3 + 4x = 1$ can be arranged to give $x = \frac{1}{4} - \frac{x^3}{4}$

$x^3+4x = 1$

$-x^3 \quad 4x = 1 - x^3$

$\div 4 \quad$ C1 $\quad x = \frac{1-x^3}{4}$ or $x = \frac{1}{4} - \frac{x^3}{4}$

(1)

(c) Starting with $x_0 = 0$, use the iteration formula $x_{n+1} = \frac{1}{4} - \frac{x_n^{\,3}}{4}$ twice, to find an estimate for the solution of $x^3 + 4x = 1$

MW 180

$x_1 = \frac{1}{4} - 0 = 0.25$ B1

$x_2 = \frac{1}{4} - \frac{0.25^3}{4} = \frac{63}{256}$

M1

$= 0.24609\ldots$

A1

$\frac{63}{256}$ or $0.246\ldots\ldots$ o.e.

0.246

(3)

(Total for Question 14 is 6 marks)

DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA DO NOT WRITE IN THIS AREA

15 There are 17 men and 26 women in a choir.
The choir is going to sing at a concert.

One of the men and one of the women are going to be chosen to make a pair to sing the first song.

(a) Work out the number of different pairs that can be chosen.

17 × 26 P1

A1

442

(2)

Two of the men are to be chosen to make a pair to sing the second song.

Ben thinks the number of different pairs that can be chosen is 136
Mark thinks the number of different pairs that can be chosen is 272

(b) Who is correct, Ben or Mark?
Give a reason for your answer.

17 × 16 ÷ 2 = 136

C1

Ben is correct, because it doesnot matter the order the men are chosen, eg chosing Ben & Mark is the same as chosing Mark then Ben.

(1)

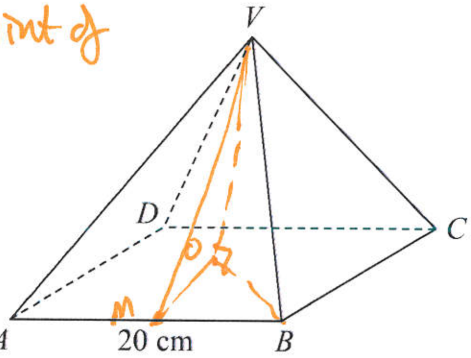
(Total for Question 15 is 3 marks)

MW218

16 *VABCD* is a solid pyramid.

let O be the midpoint of the square base

& let M be the midpoint of AB

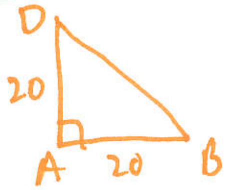


ABCD is a square of side 20 cm.

The angle between any sloping edge and the plane *ABCD* is 55°

Calculate the surface area of the pyramid.
Give your answer correct to 2 significant figures.

In Δ DAB



Pythagoras

$BD^2 = 20^2 + 20^2$

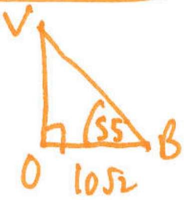
$BD^2 = 800$

$BD = 20\sqrt{2}$

$OB = 10\sqrt{2} = 14.14$

P1

In Δ VOB



$\tan 55° = \frac{OV}{10\sqrt{2}}$

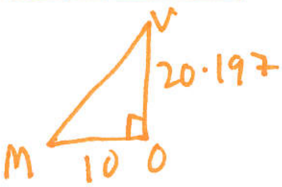
$OV = 10\sqrt{2} \times \tan 55°$

$OV = 20.197$

P1

& Note process marks allow for f.t.o

In Δ VOM



Pythagoras

$VM^2 = 20.197^2 + 10^2$

$VM^2 = 507.92$

$VM = 22.537$

P1

Area of Δ face $= \frac{1}{2} \times 20 \times 22.537 = 225.37$ P1

Total surface area $= 4 \times 225.37 + 20^2$
$= 901.48 + 400$

1301 cm^2 A1

(Total for Question 16 is 5 marks)

A1 ⇒ allow 1300 – 1302 inclusive.

17 Louis and Robert are investigating the growth in the population of a type of bacteria. They have two flasks A and B.

At the start of day 1, there are 1000 bacteria in flask A.
The population of bacteria grows exponentially at the rate of 50% per day.

MW164
MW163

(a) Show that the population of bacteria in flask A at the start of each day forms a geometric progression.

multiply by 1·5 each time C1

1000, 1500, 2250, 3375, ... M1

show ~~first~~ 3 terms.

(2)

The population of bacteria in flask A at the start of the 10th day is k times the population of bacteria in flask A at the start of the 6th day.

(b) Find the value of k.

Start of 6th day $1000 \times 1.5^5 = 7593.75$
Start of 10th day $1000 \times 1.5^9 = 38443$ P1

$38443 \div 7593.75$

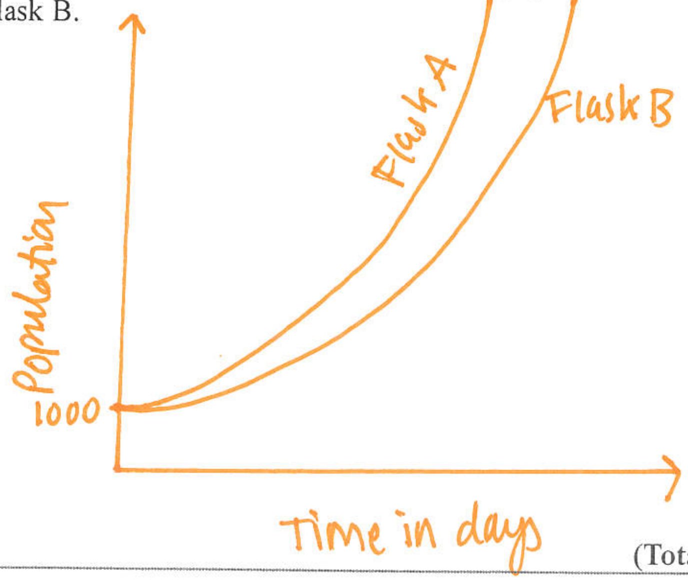
OR $\boxed{1.5^4}$ on P1 (5.0625) o.e. $\frac{81}{16}$. A1

(2)

At the start of day 1 there are 1000 bacteria in flask B.
The population of bacteria in flask B grows exponentially at the rate of 30% per day.

MW 194

(c) Sketch a graph to compare the size of the population of bacteria in flask A and in flask B.



*Not labelled
Do Not get the mark.

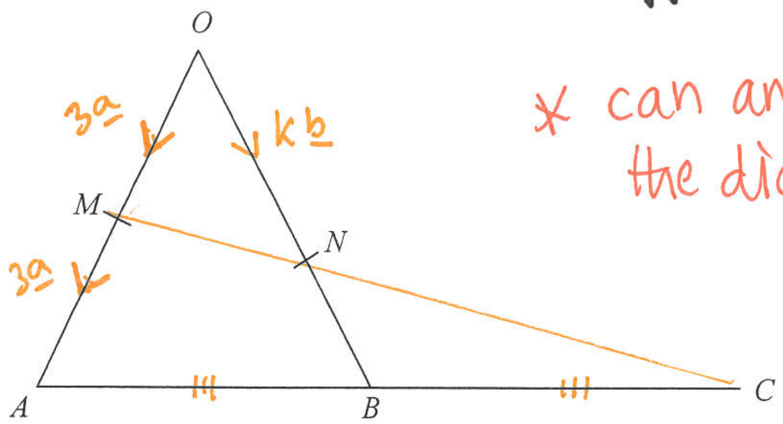
C1 both exponential curves must be shown & labelled & must cross/intersect on y axis.

(1)

(Total for Question 17 is 5 marks)

18

MW 219



* can annotate the diagram.

an easy mark!

(P1) $\overrightarrow{OM} = 3\underline{a}$

OR $\overrightarrow{MA} = 3\underline{a}$

OMA, *ONB* and *ABC* are straight lines.
M is the midpoint of *OA*.
B is the midpoint of *AC*.
$\overrightarrow{OA} = 6\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{ON} = k\mathbf{b}$ where k is a scalar quantity.

Given that *MNC* is a straight line, find the value of *k*.

$\overrightarrow{AB} = -6\underline{a} + 6\underline{b}$ (P1) $\overrightarrow{AC} = -12\underline{a} + 12\underline{b}$

$\overrightarrow{MC} = 3\underline{a} - 12\underline{a} + 12\underline{b} = -9\underline{a} + 12\underline{b}$
$\overrightarrow{MN} = -3\underline{a} + k\underline{b}$ } (P1)

MNC is a straight line
so $\overrightarrow{MC}$ is a multiple of $\overrightarrow{MN}$
$-9\underline{a} + 12\underline{b}$ $-3\underline{a} + k\underline{b}$
compare coefficients of $\underline{a}$ (x3) ⇒ coefficients of $\underline{b}$ } (P1)
Then $12 = 3k$
$\underline{k = 4}$. (A1)

(Total for Question 18 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Pearson Edexcel Level 1/Level 2 GCSE (9-1) in Mathematics - Sample Assessment Materials (SAMs) - Issue 2 - June 2015