Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 Liam, Sarah and Emily shared some money in the ratio 2 : 3 : 7
Emily got £80 more than Liam.

How much money did Sarah get?

(Total for Question 1 is 3 marks)

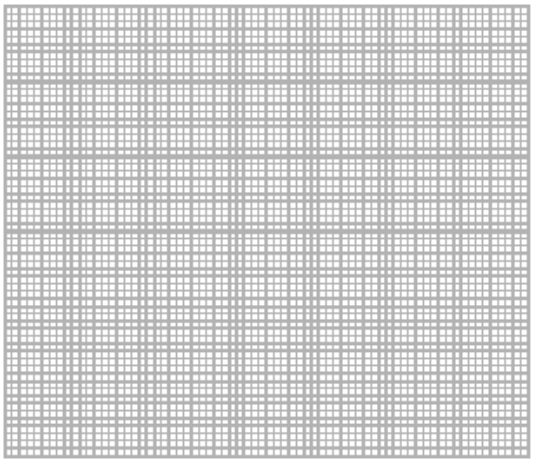
Same as Q1 on Draft SAMs

2 The table shows the life expectancy (in years) for males born in the UK from 2000 to 2012.

Year of birth	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Life expectancy (years)	75.4	75.7	75.8	76.1	76.6	76.9	77.2	77.4	77.6	78.1	78.4	78.8	79.0

(Data from statistics.gov.uk)

(a) Use this information to predict the life expectancy of a male born in 2030.



(4)

(b) Make two comments explaining why your prediction in part (a) may not be reliable.

(2)

(Total for Question 2 is 6 marks)

Based on Q2 on Draft SAMs (b) has changed

(ii) Evaluate the reliability of your result.

(Total for Question 2 is 6 marks)

3 Given that $A = 2^4 \times 3^3 \times 5$ and $B = 2^3 \times 3 \times 5^2$

write down, as a product of powers of its prime factors,

(i) the highest common factor (HCF) of A and B

(ii) the lowest common multiple (LCM) of A and B.

(Total for Question 3 is 2 marks)

Same as Q3 on Draft SAMs

4 A rectangular piece of card $ABCP$ is placed on a horizontal straight line.

The card is first rotated 90° clockwise about C.
The card is then rotated 90° clockwise about B.
The card is then rotated 90° clockwise about A.

Draw the locus of the vertex P.

(Total for Question 4 is 3 marks)

Same as Q4 on Draft SAMs

5 (a) Solve the simultaneous equations $3x + 5y = 4$

$2x - y = 7$

(3)

(b) Find the integer value of x that satisfies both the inequalities

$x + 5 > 8$ and $2x - 3 < 7$

(3)

(2)

(Total for Question 5 is 5 marks)

Same as Q5 on Draft SAMs BUT now worth 6 marks

6 Modelling the planet Mercury as a sphere, it has a radius of 2440 km.

(a) (i) Work out an estimate in square kilometres for the surface area of Mercury.

(ii) Without carrying out a further calculation, give evidence to show whether your method gives you an underestimate or an overestimate for the surface area of Mercury.

(3)

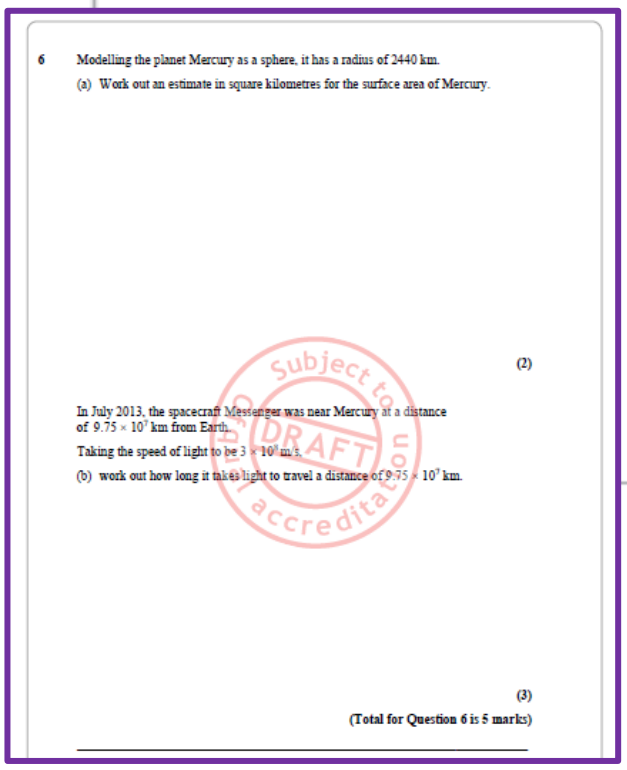
In July 2013, the spacecraft Messenger was near Mercury at a distance of 9.75×10^7 km from Earth.

Taking the speed of light to be 3×10^8 m/s,

(b) work out how long it takes light to travel a distance of 9.75×10^7 km.

(3)

(Total for Question 6 is 6 marks)



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(3)

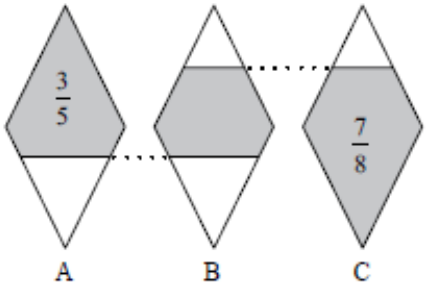
(Total for Question 6 is 5 marks)

Based on Q5 on Draft SAMs BUT now worth 6 marks

7 The diagram shows three identical shapes A, B and C.

$\frac{3}{5}$ of shape A is shaded.

$\frac{7}{8}$ of shape C is shaded.



What fraction of shape B is shaded?

(Total for Question 7 is 3 marks)

Same as Q8 on Draft SAMs

8 On a farm, $4\frac{1}{2}$ out of every 15 acres of the land are used to grow crops.

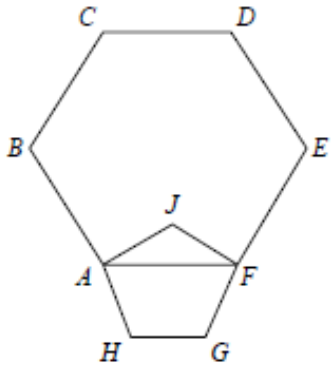
Wheat is grown on $\frac{5}{8}$ of the land used to grow crops.

What percentage of the total area of the land on the farm is used to grow wheat?

(Total for Question 8 is 3 marks)

Same as Q9 on Draft SAMs

9 *ABCDEF* is a regular hexagon.
AJFGH is a regular pentagon.



Work out the size of angle *BAJ*.

(Total for Question 9 is 4 marks)

Based on Q10 on Draft SAMs BUT now worth 4 marks

10 Ishmael is a salesperson for a company.

His monthly wage is made up of his fixed basic wage plus commission.
His commission for a month is a fixed percentage of the sales he makes that month.

The table gives some information about his monthly wages.

Month	Monthly wage (£)	Sales (£)
June	1700	20 000
July	2200	30 000
August	2050	27 000

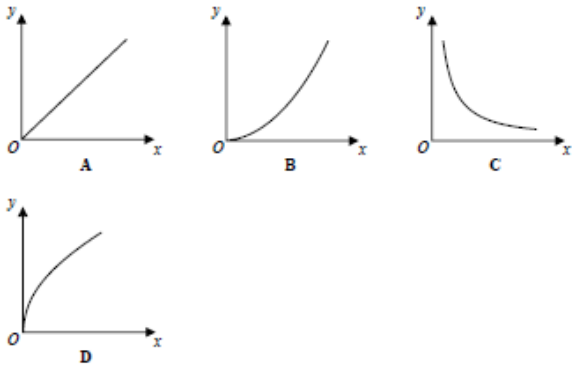
In September, Ishmael's monthly wage was £1850

Work out his sales, in £, for September.

Same as Q11 on Draft SAMs

(Total for Question 10 is 4 marks)

11 Here are four graphs.



(a) Write down the letter of the graph that could represent

y is proportional to x^3

Based on Q12 on Draft SAMs BUT now worth 6 marks (not 7)

(b) The force of attraction, F newtons, between two magnets varies inversely as the square of the distance, d cm, between the two magnets.

(i) What happens to the force of attraction between the magnets when the distance between the magnets is doubled?

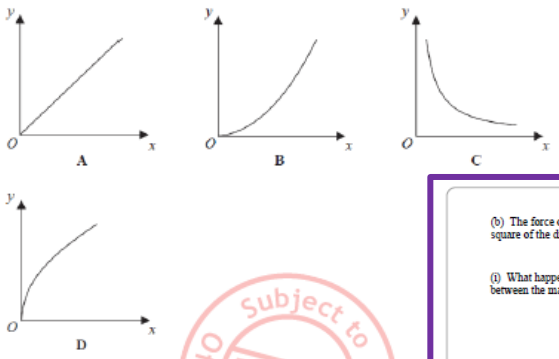
When the magnets are 3 cm apart the force of attraction between them is 40 newtons.

(ii) What is the force of attraction between the magnets when they are 10 cm apart?

(5)

(Total for Question 11 is 6 marks)

12 (a) Here are four graphs.



(i) Which graph could represent the relationship

y is proportional to x^2 ?

(ii) Which graph could represent the relationship

y is inversely proportional to x?

(b) The force of attraction, F newtons, between two magnets varies inversely as the square of the distance, d cm, between the two magnets.

(i) What happens to the force of attraction between the magnets when the distance between the magnets is doubled?

When the magnets are 3 cm apart the force of attraction between them is 40 newtons.

(ii) What is the force of attraction between the magnets when they are 10 cm apart?

(5)

(Total for Question 12 is 7 marks)

12 The functions f and g are such that

$$f(x) = 1 - 5x \qquad \text{and} \qquad g(x) = 1 + 5x$$

(a) Show that $gf(1) = -19$

(2)

(b) Prove that $f^{-1}(x) + g^{-1}(x) = 0$ for all values of x.

(3)

(Total for Question 12 is 5 marks)

13 The functions f and g are such that

$$f(x) = 1 - 5x \qquad g(x) = 1 + 5x$$

(a) Find f(2)

(1)

(b) Find gf(x)

(2)

(c) Prove that $f^{-1}(x) + g^{-1}(x) = 0$ for all values of x.

(2)

(Total for Question 13 is 5 marks)

Based on Q13 on Draft SAMs

13 A car has an initial speed of u m/s.

The car accelerates to a speed of $2u$ m/s in 12 seconds.

The car then travels at a constant speed of $2u$ m/s for 10 seconds.

Assuming that the acceleration is constant, show that the total distance, in metres, travelled by the car is $38u$.

uestion 13 is 4 marks)

14 A car has an initial speed of u m/s.

The car accelerates to a speed of $2u$ m/s in 12 seconds.

The car then travels at a constant speed of $2u$ m/s for 10 seconds.

(i) Assuming that the acceleration is constant, show that the total distance, in metres, travelled by the car is $38u$.

(ii) How did you use the assumption that the acceleration is constant in your solution?

(Total for Question 14 is 5 marks)

Based on Q14 on Draft SAMs

BUT now worth 4 marks not 5

14 Here is a board for a game.

Jim begins with a counter on **Start**.
He rolls a fair dice.

He moves his counter one square to the right when the dice lands on 1 or on 2 or on 3 or on 4

Otherwise he moves his counter one square to the left.

Jim rolls the dice twice and moves his counter twice.

(a) Work out the probability that his counter will then be on the square with 2 on it.

(2)

Jim puts the counter back on the **Start** square.

He rolls the dice 3 times and moves his counter three times.

(b) Work out the probability that his counter will then be on the square with −1 on it.

Jim wins the game when his counter lands on a square with **Win** on it.

Jim says:

"I cannot win in an even number of throws of the dice."

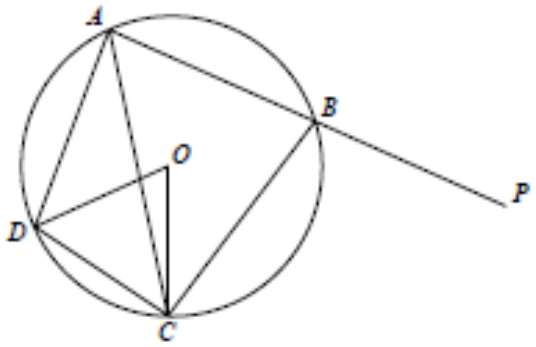
(c) Explain whether or not Jim is correct.

Same as Q15 on Draft SAMs

(1)

(Total for Question 14 is 6 marks)

15

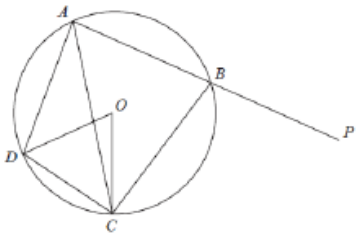


A, *B*, *C* and *D* are four points on a circle, centre *O*.

PBA is a straight line.
Angle *PBC* = 100°.
Angle *DAC* = 23°.

Show that the size of angle *OCA* = 10°
You must give a reason for each stage of your working.

16



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PBA is a straight line.
Angle *PBC* = 100°
Angle *DAC* = 23°

Work out the size of angle *OCA*.

(Total for Question 16 is 5 marks)

Based on Q16 on Draft SAMs

BUT now worth 6 marks not 5

al for Question 15 is 6 marks)

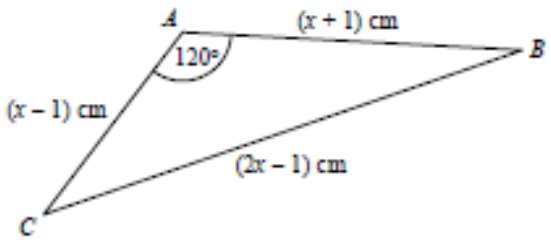
16 (i) Sketch the graph of $f(x) = x^2 - 5x + 10$, showing the coordinates of the turning point and the coordinates of any intercepts with the coordinate axes.

Same as Q17 on Draft SAMs

(ii) Hence, or otherwise, determine whether $f(x + 2) - 3 = 0$ has any real roots. Give reasons for your answer.

(Total for Question 16 is 6 marks)

17 The diagram shows triangle ABC.



The area of triangle ABC is $k\sqrt{3}$ cm^2.

Find the exact value of k.

Same as Q18 on Draft SAMs

(Total for Question 17 is 7 marks)

THE FOLLOWING HAVE BEEN REMOVED:

7 The median of five consecutive integers is n.

Show that the difference between the mean and the median of the squares of the five integers is always 2

(Total for Question 7 is 3 marks)