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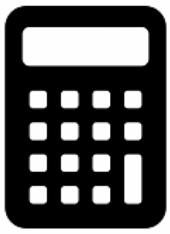
GCSE 9 -1
Mathematics
Higher Tier
Grade 9 'Tough Paper'
Paper 2



Total marks 80
1 Hour 30 minutes

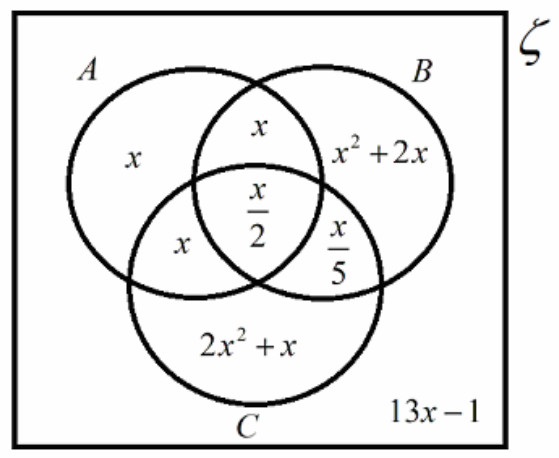
PLEASE NOTE:
This paper does not claim the questions included are 'Grade 9 questions'.
This paper was designed for pupils aiming for Grade 9s who are looking for challenging questions within the GCSE 9-1 syllabus.

(1) Island X is a small island.
In the winter of 1986 the ratio of natives to tourists on the island was 7:1.
In the summer of 1987 the ratio of natives to tourists on the island was 155:69.
The number of natives on the island decreased by 100 from the winter of 1986 to summer of 1987.
The number of tourists on the island increased by 220 from the winter of 1986 to summer of 1987.

Find the number of tourists that were there on Island X in the winter of 1986.

(Total for Question 1 is 4 marks)

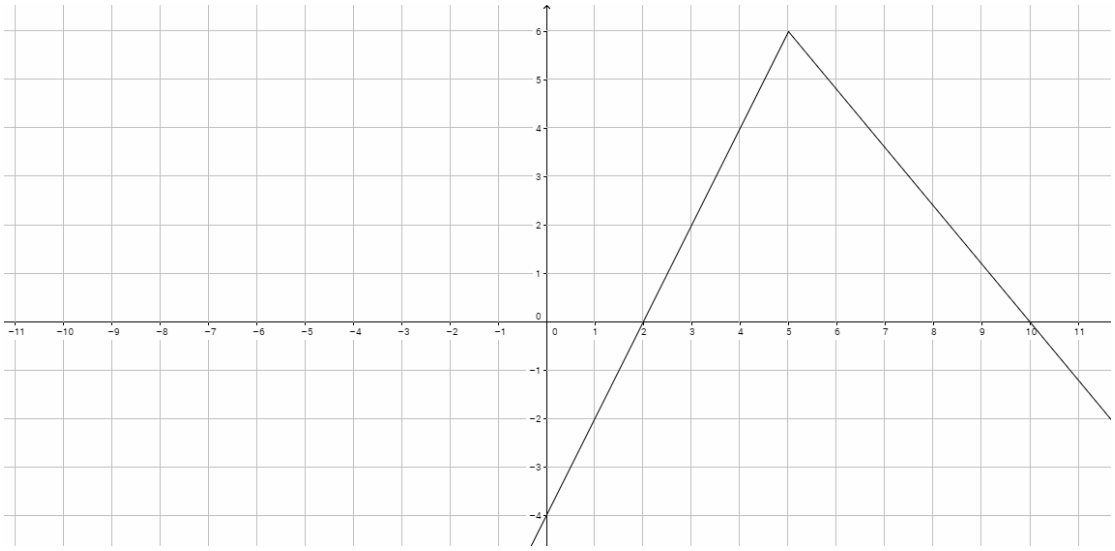
(2) Find $P(B \cap A' | C)$.



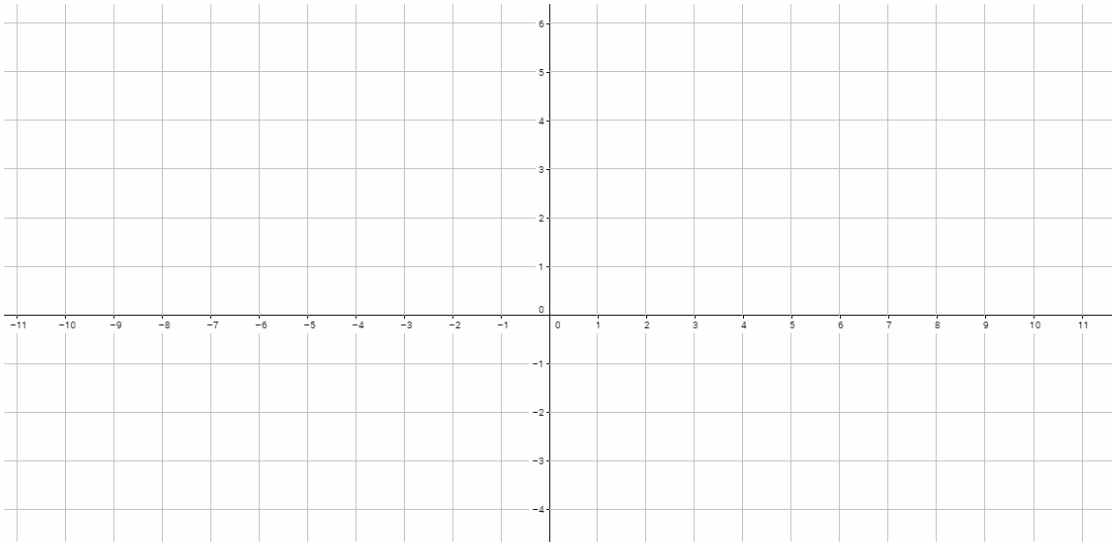
Give your answer as a fraction in the form $\frac{a}{b}$ where a and b are integers.

(Total for Question 2 is 5 marks)

(3) The diagram below shows part of the graph of $y = 2\,\mathrm{f}\left(x-1\right)$



On the grid below draw the graph of $y = -\,\mathrm{f}\left(-x\right)$



(Total for Question 3 is 4 marks)

(4) Using algebra, show that part of the line $3x + 4y = 0$ is a diameter of the circle with equation $x^2 + y^2 = 25$.

(Total for Question 4 is 6 marks)

(5) Sue is making a toy rocket in her science lesson which is to be launched from the ground.

The flight path of the toy rocket can be modelled by the equation $h = -2t^2 + 6t + 1$.

h is the height in metres the rocket reaches above the ground.

t is the time in seconds after the rocket is launched.

Find the maximum height above the ground that the rocket reaches and the time it takes to reach this height.

(Total for Question 5 is 5 marks)

(6) Shape A is a regular polygon.
The ratio of the size of the interior angle to the size of the exterior angle is 7:2.
The ratio of the side **length** to the **number** of sides is 5:3.
Find the perimeter of Shape A.

(Total for Question 6 is 4 marks)

(7) Jamal is going to paddle between 3 points on a large lake.
Jamal will start from Point A and paddle on a bearing of 050^0 until he reaches Point B.
Once at Point B, Jamal will then paddle 1.6km on a bearing of 142^0 to reach Point C.
Finally Jamal will paddle directly back to Point A from Point C where he will finish.
The bearing of Point C from Point A is 098^0.

Given that Jamal can paddle at an average speed of 7.2kph, find the time it will take him to paddle directly back to Point A from Point C.

Give your answer to the nearest minute.

(Total for Question 7 is 6 marks)

(8) Triangle ABC is an isosceles triangle.

$AB = BC$

The points X and Y lie on the line AC.

$AY = 3AX$

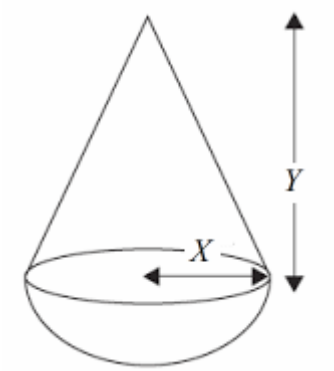
$AC = 4AX$

Prove that triangle ABX and triangle CBY are congruent.

(Total for Question 8 is 3 marks)

(9) Company T are designing a toy to be sold online.
The toy will be made up of a hemisphere with radius Xcm and a right cone with radius Xcm and height Ycm.
The cone will be attached to the top of the hemisphere as shown below.

Given that the total mass of the toy is 100π grams and the density of the toy is $60\ g/cm^3$, express Y in terms of X.
Give your answer in its simplest form.



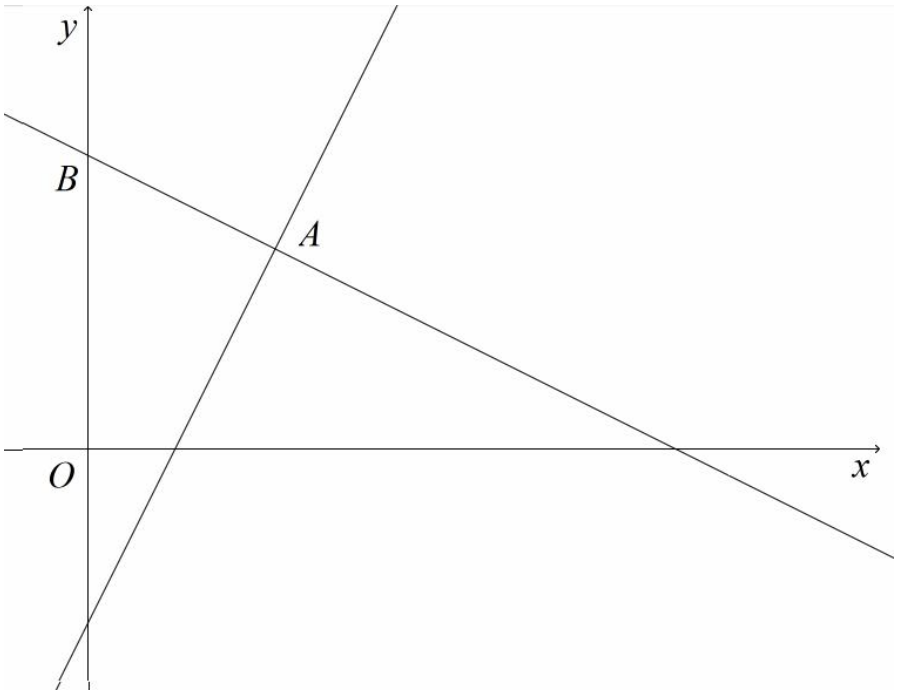
(Total for Question 9 is 6 marks)

(10) There are N boys in a class at school.
For every 2 boys in the class there are 3 girls in the class.
3 students are chosen at random and taken out of the class.

Given that the probability of choosing 3 boys is $\frac{1}{30}$, show that $23N^2 - 114N + 88 = 0$

(Total for Question 10 is 5 marks)

(11) The diagram below shows Line 1 and Line 2.

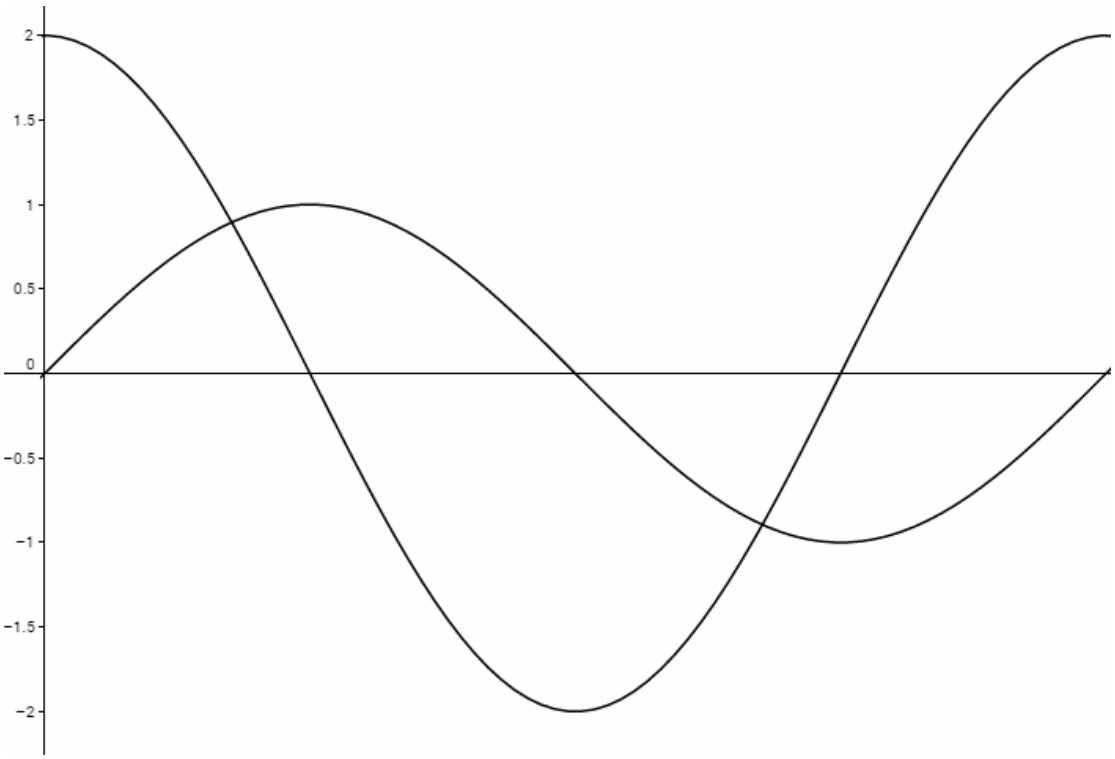


Line 1 has gradient 2.
Line 2 is perpendicular to Line 1.
Line 1 and Line 2 intersect at the point $A(p, q)$.
Line 2 crosses the y axis at the point B.

Show that the coordinates of point B can be written as $\left(0, \frac{p}{2} + q\right)$.

(Total for Question 11 is 4 marks)

(12) The graphs of $y = 2\cos(x)$ and $y = \sin(x)$ are shown in the diagram below for $0 \leq x \leq 360^o$.



Use the graphs to find estimates for the solutions of the equation:

$$\sin(x) - 2\cos(x) = 0 \text{ for } 0 \leq x \leq 360^o.$$

You must show all of your working.

(Total for Question 12 is 4 marks)

(13) Make t the subject of the equation $s = ut + \frac{1}{2}at^2$.

(Total for Question 13 is 5 marks)

(14) The students in Class X and Class Y sat the same maths exam.
Information is given about the performance of each class in the table below.

	X	Y
Lowest Score	$x-1$	$y+1$
Lower Quartile	$x+2$	$2(y+1)$
Median	x^2-3	$y(y-1)$
Upper Quartile	$4x+2$	$3y+1$
Highest Score	$2(x^2+2)$	$5y-4$

The median score for Class X was half the median score for Class Y.
The interquartile range for Class X was three times the interquartile range for Class Y.

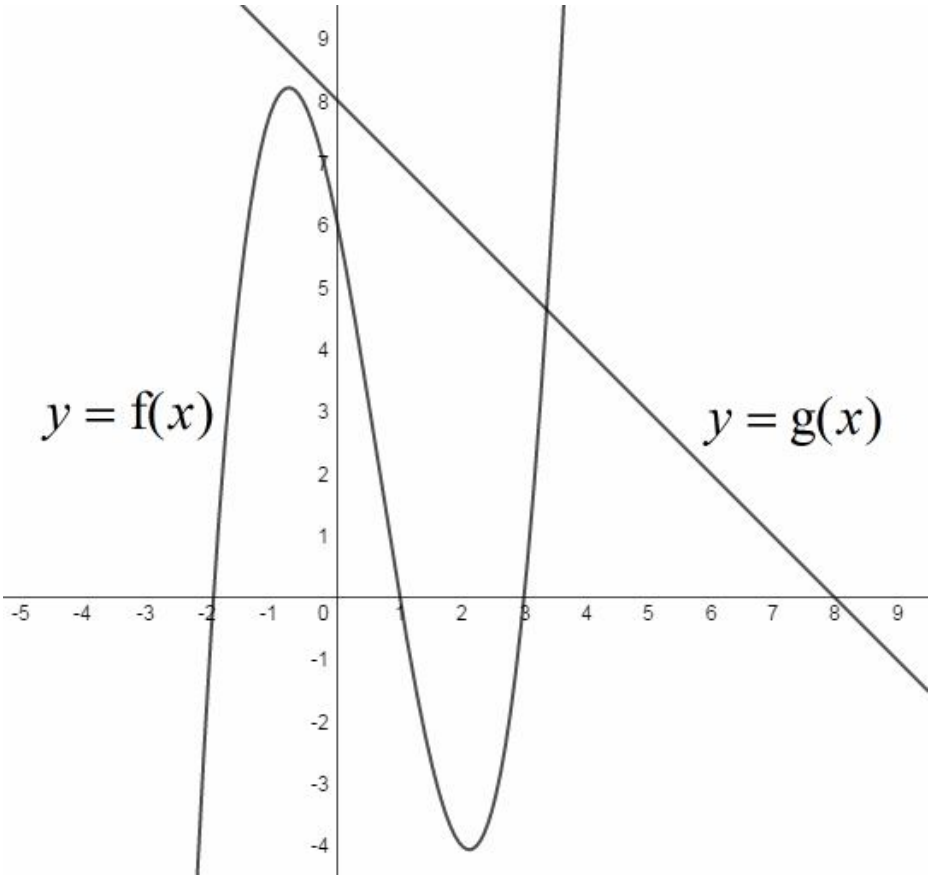
Michael scored 17 marks in his maths exam.
Complete the following sentence;

"Michael was in the top_____% of performers in Class___"

You must show all of your working.

(Total for Question 14 is 6 marks)

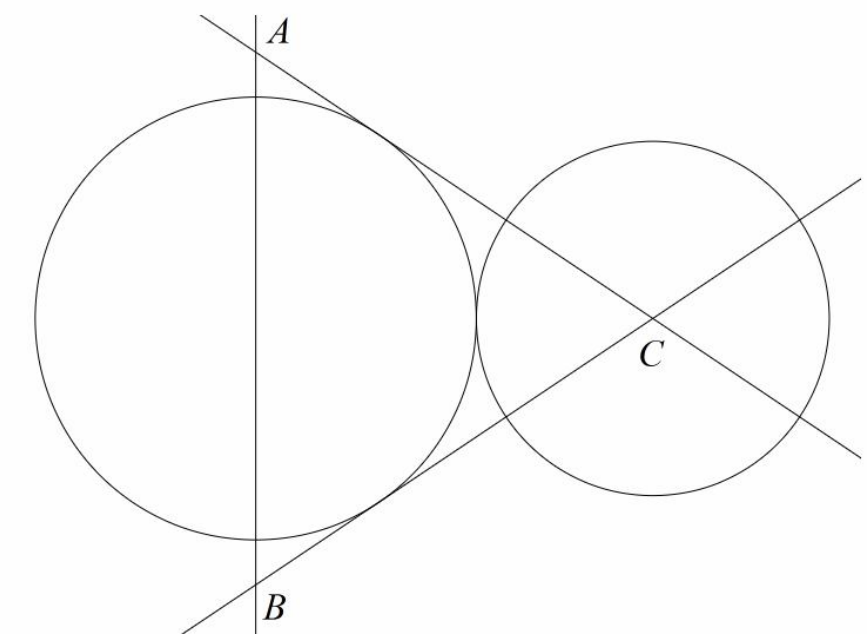
(15) The diagram below shows parts of the graphs of $y = f(x)$ and $y = g(x)$.



Find the integer value of $gff(-2)$.

(Total for Question 15 is 3 marks)

(16) The diagram below shows two touching circles, Circle 1 and Circle 2.



Circle 1 has radius 5cm.
Circle 2 has radius 4cm.
C is the centre of the Circle 2.
The line AB lies on a diameter of Circle 1 .
The line AB is perpendicular to a line passing through the centre of both circles.
AC and BC are tangents to Circle 1 and pass through C .

Find the area of triangle ABC .
Give your answer to 3 significant figures.

(Total for Question 16 is 5 marks)

(17) The area of a parallelogram is $15 cm^2$ correct to the nearest integer.
The shortest side of the parallelogram is $4.5 cm$ correct to 2 significant figures.
The longest side of the parallelogram is $7.1 cm$ correct to 2 significant figures.

Find the largest possible size of the two acute angles in the parallelogram.
Give your answer correct to 3 decimal places.

(Total for Question 17 is 5 marks)
TOTAL FOR PAPER IS 80 MARKS