Name ………………………..……………………

School ………………………..……………………

WINCHESTER

COLLEGE

Winchester Entrance and Election

Mathematics I

0900-1030 4th May 2022

Time allowed: 1 hour 30 minutes

Total marks: 100

CALCULATORS ARE NOT ALLOWED.

Write your answers in this booklet. If you need additional space, please write on sheets of A4 paper and attach them to this booklet. You should show all your working so that credit may be given for partly correct answers.

Diagrams are not drawn to scale.

Do not be discouraged if you do not finish. If you get more than 60 marks you will have done well.

1.	a) Find $\frac{3}{7}$ of 42.	b) Find 30% of 150.	[2] [2]

2. 24, written as the product of its prime factors, is $2^3 \times 3$.

a) Write 18 as the product of its prime factors. [1]

b) What is the highest common factor of 18 and 24? [1]

c) $60 = 2^2 \times 3 \times 5$ and $75 = 3 \times 5^2$.
What is the lowest common multiple of 60 and 75? [1]

3.	Calculate:		
	a) $11 \times 121 =$	b) $5432 - 433 =$	[1] [1]
	c) $5432 - (5432 - 19) =$	d) $(\sqrt{169})^2 =$	[1] [1]
	e) $\dfrac{133 + 134 + 135}{3} =$	f) $2 \times 678 \times 5 + 9 =$	[1] [1]
	g) $\sqrt{640000} =$	h) $6 \div 0.4 =$	[2] [2]

4.	Find in the simplest form:		
	a) $1\dfrac{1}{13} - \dfrac{4}{13}$	b) $\dfrac{39}{7} \times \dfrac{14}{33} \times \dfrac{11}{13}$	[1] [2]
	c) $\dfrac{9}{17} \div \dfrac{45}{51}$	d) $\dfrac{\frac{1}{2} + \frac{1}{4}}{\frac{1}{3} + \frac{1}{6}}$	[3] [3]

5.	a) Find 48% of 50% of 400.	b) Evaluate $\sqrt[3]{9 \times 33 \times 121}$.	[2] [2]
	c) Evaluate $\sqrt{\dfrac{27}{48}}$.	d) Evaluate $\dfrac{(-2)^{17}}{(-2)^4 \times (-2)^8}$.	[2] [3]
5.			

6.

a) Solve $3x + 7 = 40$. [1]

b) Solve $\dfrac{56}{2x + 1} = -8$. [2]

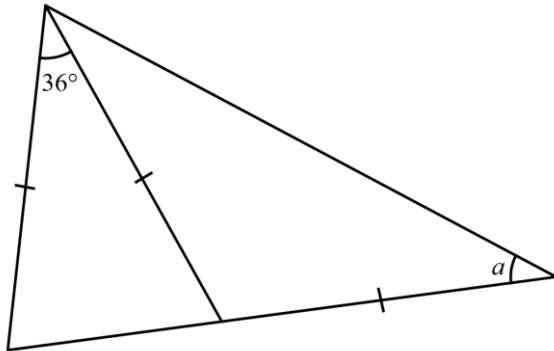c) Solve $\sqrt{\left(3 + \dfrac{2x}{5}\right)^3} = 8$.

d) a and b are integers. b is 80% more than a. Find and simplify the ratio $a:b$. [3] [2]

7.	$a = 5$, $b = -3$ and $c = 17$. Find the value of:		
	a) $\dfrac{14a}{b + c}$	b) $\dfrac{a^3}{25}$	[1] [1]
	c) $\dfrac{100a + 100b + 100c}{a + b + c}$	d) $\sqrt{2a - 3b + 6c}$	[1] [2]
	e) $\dfrac{c^2 - a^2}{c - a}$	f) $(a^2 + ab + b^2)(a - b)$	[2] [2]

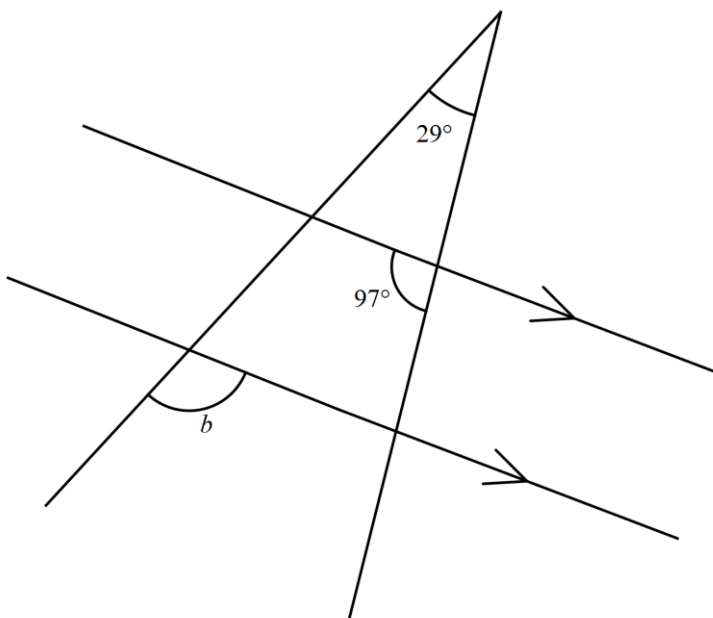| 8.	a) In the diagram below the three marked lengths are equal. Find *a*.	[3]

a) In the diagram below the three marked lengths are equal. Find *a*. [3]

b) The diagram below shows four lines, two of which are parallel. Find *b*. [3]

9.	Order the numbers below from smallest to largest. (*Hint: Try squaring the numbers.*)	
	a) $4\sqrt{3}, \ \sqrt{50}, \ 7, \ 3\sqrt{5}, \ 2\sqrt{13}.$	[3]
	b) $295 \times 305, 290 \times 310, 299 \times 301.$	[2]
	c) $\dfrac{1}{2}, \dfrac{4}{9}, \dfrac{6}{13}, \dfrac{10}{21}, \dfrac{5}{11}, \dfrac{8}{17}.$	[3]

10.	Each of the small circles has radius two. The innermost circle is just touching the six which surround it, and each of those circles are just touching each of their neighbours and the large circle. For these questions please leave π in your answer.	
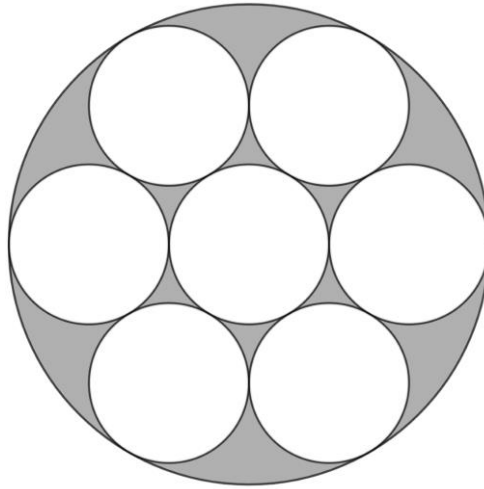
a) Determine the circumference of the large circle. [2]

b) Determine the shaded area. [3]

11. a) Find the median of the square numbers from 1 to 169 (inclusive).

[1]

b) Four friends are aged 12, 12, 15 and 17. They are by themselves in a room. Four more people, all the same age, enter the room and the mean age increases by 3. How old are the newcomers?

[2]

c) Three sisters are aged 8, 9 and 14. When their friend Kelly is with them the mean of their ages is equal to the median. How old could Kelly be? Show working to justify your answer. (There is more than one answer.)

[3]

11.

12.	Harry is training for a running race. A training session consists of a 1 minute sprint followed by a 30 second jog repeated 10 times. He sprints twice as fast as he jogs.	
	a) How long is the entire training session?	[1]
	b) In the training session he travels exactly 6km. For what fraction of the **distance** was he sprinting?	[2]
	c) Exactly how long has Harry been travelling for when he has travelled 2km?	[3]
12.		

13.	Chloe writes a list, in order, of all the whole numbers that are written using no digits other than 1s and 5s. The list begins:	

$$1, 5, 11, 15, 51, ...$$

a) How many numbers in the list are less than 1000? [2]

b) Which number in this list comes directly before 115511? [1]
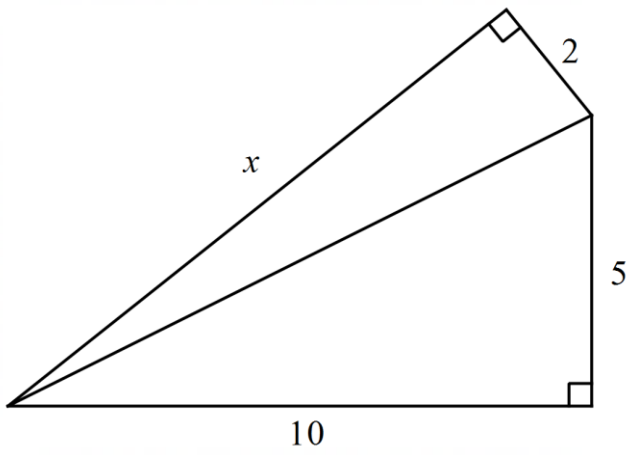
c) What is the 32nd number in the list? [2]

d) What is the average of all the numbers in the list that are more than 100,000 but less than 1,000,000? [3]

13.

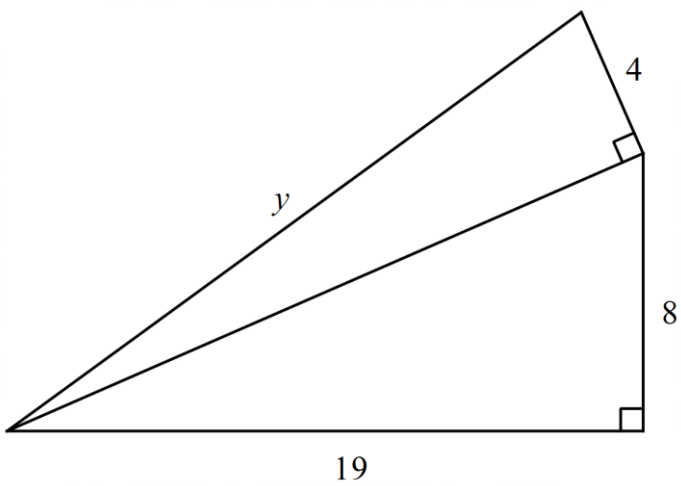| 14.	The diagram shows two right angled triangles.	
	a) Find the value of x.	[2]

The diagram shows two right angled triangles.	
b) Find the value of y.	[2]

c) ABCDEFGH is a box in the shape of a cuboid.

A thin rod of length 21cm just fits inside the box with one end at A and the other at G.
If the same rod has one end at A and passes through C, exactly 1cm sticks out of the box.
If the same rod has one end at A and passes through H, exactly 2cm sticks out of the box.
If the same rod has one end at A and passes through F, exactly $z$cm sticks out of the box.
*(In the diagram, sections of the rod inside the box are dotted, parts outside are **solid**.)*
Find z.

[5]

2

H   G

21   z

1

D

C

E   F

A

B