$\qquad$


# ST PAUL'S SCHOOL JUNIOR SCHOLARSHIP EXAMINATION 

## MAY 2015

## MATHEMATICS

## 2 hours

Write all your answers and working on this question paper.
You may use rough paper if you wish but this should not be handed in.
Answer as many questions as you can in any order you wish.
Credit will be given for reasoning and working where appropriate.
When the answer is a fraction it should be given in mixed form, e.g. $3 \frac{4}{5}$

The total number of marks for this paper is 90 .
The mark allocation is shown in brackets at the end of each part of each question.
Please write your full name and school at the top of this page.

1 You are told that $97 \times 19=1843$. Use this to work out the values of
(a) $9.7 \times 1.9$
(2)
(b) $\frac{18430}{1.9}$

Answer:

Answer:
(c) $\frac{18.43}{0.097}+1$

Answer:
(d) $\frac{1.843}{0.019 \times 2}$

Answer:
(2)

2 Solve the following equations.
(a) $2(f+5)+3(10-f)=6 f-2$

$$
\begin{equation*}
f= \tag{3}
\end{equation*}
$$

(b) $-3-\frac{d}{2}=5$

$$
\begin{equation*}
d=. \tag{2}
\end{equation*}
$$

(c) $10-3\left(2+\frac{x}{3}\right)=1$

3 I spent one fifth of my money on Monday and one quarter of the remainder on Tuesday. I was left with $£ 15$. How much money did I start with on Monday?

## Answer: $£$.

4


In the diagram, which is not drawn accurately, $O$ is the point indicated by the arrow.

$$
\begin{aligned}
& O C=O D, \angle B O C=x \\
& \angle A O D=\angle A O B=2 x \\
& \text { and } \angle O B C=\angle O C B=y .
\end{aligned}
$$

(i) Find the value of $x$, and hence find the size of $\angle A D C$, in degrees.

Answer: $\angle A D C=$
(ii) What shape is $D O B C$ ? Explain your answer.

Shape:
Explanation: $\qquad$
$\qquad$
$\qquad$

5 In a class test the average mark of five boys was 12 and the average mark of 15 girls was 10 .
(i) Find the average mark for the class.

Answer:
(ii) Peri's mark was missed out. Including her mark, the average mark for the class was $1 / 2$ a mark higher. What mark did Peri obtain?

## Answer:

6 This flower is made up of 4 semicircles. The smaller three are of equal radius and the radius of the large semicircle is 6 cm . Find the perimeter of the flower, giving your answer as an exact multiple of $\pi$. You should write out any formula
 you use.

7 The line drawn on the axes undergoes the following series of transformations:
(i) Reflection in the $x$ axis
(ii) Reflection in the $y$ axis
(iii) A translation of 2 units to the left and 3 units downwards.

(a) Draw the resulting line on the axes and label this line $\mathbf{L}$.
(b) The same three transformations are carried out but in a different order. The point $(0,-2)$ is transformed onto $(2,-1)$. In what order were the transformations carried out?
(i)
(ii)
(iii)

8 After playing 500 games my success rate at Spider Solitaire is $49 \%$. Assuming I win every game from now onwards, how many extra games do I need to play to increase my success rate to $50 \%$ ?

9 A fair six-sided dice is relabelled with faces showing 4, 6, 6, 8, 8, 8 .
(i) What is the probability of rolling a six in a single throw?

> Answer:
(ii) The dice is thrown twice. What is the probability of rolling a double six?

> Answer:
(iii) The dice is thrown twice. What is the probability of rolling a double?

## Answer:

10 (i) Work out $4.5^{2}$ as a decimal.

Answer:
(ii) A trick for finding the square of a number ending in '. 5 ' (call this number $x$ ) is to multiply the whole number below $x$ by the whole number above $x$ and then add 0.25 .
For example, if $x=3.5, \quad 3.5^{2}=3 \times 4+0.25=12.25$
Use algebra to prove that this trick works for any value of $x$ ending in .5 .
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

11 The latest Decimalisation Decree states that each day is to be divided into 10 new hours, each new hour is to be divided into 100 new minutes and each new minute is to be divided into 100 new seconds.
(a) Which is larger, the old second or the new second? You must show your method.

## Answer:

(b) Calculate the ratio (length of new second) to (length of old second) in its simplest form.

Answer:

12 If Harry is a good boy and does all of his chores for the week his parents will increase his pocket money by $20 \%$. If he fails to do all his chores for the week his parents will decrease his pocket money by $25 \%$. In a space of four weeks Harry manages to do all his chores in two weeks but not the other two. Will Harry's pocket money have increased or decreased, and by what percentage?

## Answer.

(3)

13 The diagram shows concentric squares and circles. The length of a side of the inner square is $x \mathrm{~cm}$. Find the length of a side of the outer square. Show all your working.


14 The diameter of the outer circle is 60 cm . The diameter of the inner circle is 40 cm . Find
(a) the ratio of circumferences of the circles, in its simplest form,


Answer:
(1)
(b) the ratio of the areas of the circles, in its simplest form.

Answer:
(2)
(c) Which area is larger, the shaded area or the unshaded area? You must show your method.
$15 \quad A B C D$ is a square. $P$ is the midpoint of $A B, Q$ is two-thirds of the way from $B$ to $C$ and $R$ is three-quarters of the way from $C$ to $D$. What fraction of the square is occupied by triangle $P Q R$ ?

## Answer:

16 A wooden cube with sides $3 \mathrm{~cm} \times 3 \mathrm{~cm} \times 3 \mathrm{~cm}$ is painted blue. It is then cut into 27 smaller cubes, each $1 \mathrm{~cm} \times 1 \mathrm{~cm} \times 1 \mathrm{~cm}$, so that those faces that were not originally on the outside are unpainted. How many of the smaller cubes have
(a) 6 unpainted faces,

Answer:
(b) 5 unpainted faces,

Answer: $\qquad$
(c) 4 unpainted faces,

Answer: $\qquad$
(d) 3 unpainted faces?

> Answer:

Now consider a large cube with sides $n \mathrm{~cm} \times n \mathrm{~cm} \times n \mathrm{~cm}$, cut into smaller cubes that are $1 \mathrm{~cm} \times 1 \mathrm{~cm} \times 1 \mathrm{~cm}$.
How many of the smaller cubes have
(e) 6 unpainted faces,

Answer: $\qquad$
(f) 5 unpainted faces,

Answer:
(g) 4 unpainted faces,

Answer:
(h) 3 unpainted faces?

Answer:
(4)

17 Each of the fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \ldots \frac{1}{9}$ can be written using all the numbers 1 to 9 , each exactly once. For example, $\frac{1}{2}=\frac{6729}{13458}$.

Complete the following:



