FOUNDED 1900

THE ENGLISH SCHOOL
A SECOND CENTURY OF EXCELLENCE

YEAR 4 MID-PROGRAMME ENTRY EXAMINATIONS 2019

MATHEMATICS

SATURDAY 1st JUNE 2019

Time allowed: 2 hours

Instructions to candidates

Answer the questions in the spaces provided – *there may be more space than you need.*
Without sufficient working, correct answers may be awarded no marks.

Information to candidates

This paper has 26 questions.
There are 19 pages in this question paper.
There is one blank page at the end of this question paper. You may use this for any additional work.
Full marks may be obtained for answers to all questions.
The total marks for this paper is 120.
The marks for each question are shown in round brackets, e.g. **(2)**
Calculators may be used.

Advice for candidates

Write your answers neatly and in good English.
Work steadily through the paper.
Do not spend too long on one question.
Show all stages in any calculations.

Materials required for the paper

Calculator, ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser. Tracing paper may be used.

1. Calculate the following giving your answer correct to 3 significant figures in standard form.

$$\frac{\sqrt{165}}{7.2 \times 10^3 - 2.7 \times 10^2}$$

………………….. **(2)**

2.

(a) Factorise the following expressions:

(i) $8x^2 - 4x$

……………….. **(2)**

(ii) $y^2 - 2y - 48$

……………….. **(2)**

(iii) $2x^2 - 162$

……………….. **(2)**

(b) Solve,

$$\frac{4}{e-3} = 5$$

$e =$ ……………….. **(2)**

3.

  (a) *(i)* Solve the inequality $2x+13>27$

  ………………….. **(2)**

  (ii) What is the minimum value x can take in this solution set?
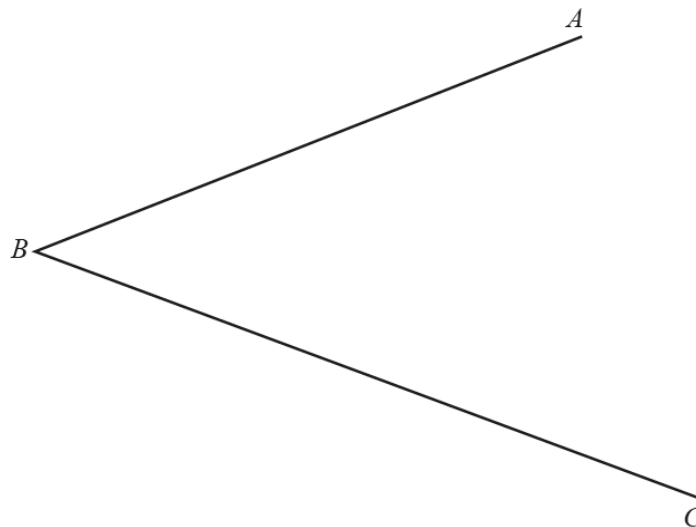
  ………………….. **(1)**

  (b) n is an integer. Write down all the values of n that satisfy $-3 < n \leqslant 2$

  ………………….. **(2)**

---

4. Using a ruler and compass only, construct the bisector of angle ABC.

(2)

5.

(a) Write 5.7×10^5 as an ordinary number.

………………….. **(1)**

(b) Write 0.0005 in standard form.

………………….. **(1)**

(c) Work out, without using a calculator, showing all steps in your working. Give your answer in standard form.

$$\frac{3 \times 10^5}{4 \times 10^{-2}}$$

………………….. **(3)**

---

6. $C = b - a$

$a = 1.2$ correct to the nearest tenth

$b = 30$ correct to the nearest integer

Work out the upper bound for the value of C. Show your working clearly. Give your answer correct to 3 significant figures.

………………….. **(3)**

7.

(a)   Simplify $e^5 \times e^3$

..………………….. **(1)**

(b)   Simplify fully $\dfrac{12g^{10}}{3g^2}$

..………………….. **(2)**

(c)   Simplify fully, $6x - 2 - 5(x-2) - 3(y-2)$

..………………….. **(2)**

(d)   Simplify fully $\dfrac{8x}{2y} \div \dfrac{16x^4}{2y^3}$

..………………….. **(3)**
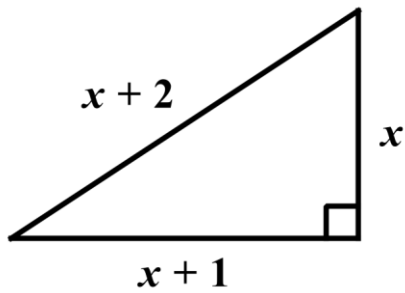
---

8. Maria invests £9000 for 7 years in a savings account.

She receives 3% per year compound interest.
How much money will Maria have in her savings account at the end of 7 years?

..………………….. **(2)**

9.

(a) Create an **algebraic equation** and solve it to find x.

$$x + 2$$

$$x$$

$$x + 1$$

$x = $ …………………..

(b) Hence find the area of the triangle.

$Area = $ …………………..

(6)

___

10. A bag contains red, yellow and blue marbles. A marble is chosen at random. The probability that the marble is red is 0.1 and the probability that the marble is blue is 0.3.

(a) What is the probability that a marble chosen at random is yellow?

………………….. **(2)**

(b) There were 20 red marbles in the bag to start with. How many yellow marbles were there in the bag?
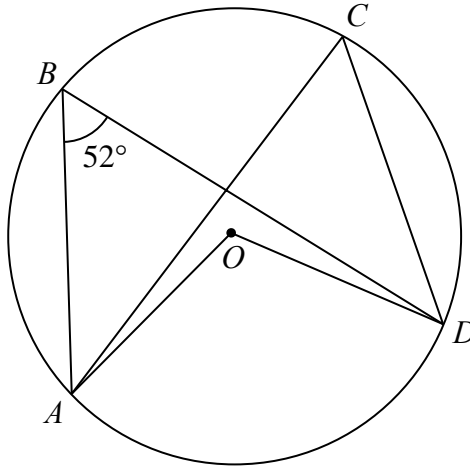
………………….. **(2)**

___

11.

A, *B*, *C* and *D* are points on a circle, centre *O*.
Angle *ABD* = 52°

(a)

(i) Write down the size of angle *ACD*.

………………….. °

(ii) Give a reason for your answer.

…………………..……………………..…………………………..…………………………..…………………………..…

…………………..……………………..…………………………..…………………………..…………………………..…

(2)

(b)
(i) Write down the size of angle *AOD*.

………………….. °

(ii) Give a reason for your answer.

…………………..……………………..…………………………..…………………………..…………………………..…

…………………..……………………..…………………………..…………………………..…………………………..…

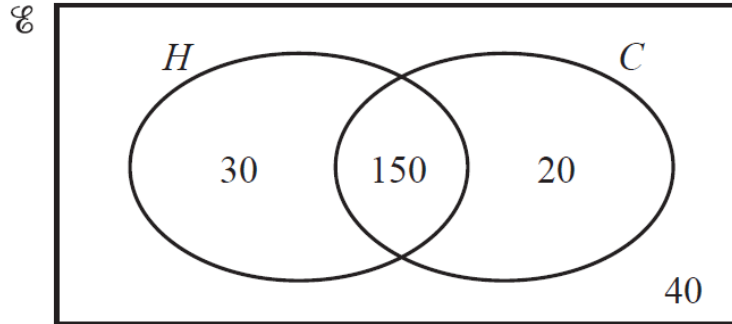**(2)**

12.

$\mathscr{E}$ = {240 customers in a shopping mall}

H = {number of customers who bought a hat}

C = {number of customers who bought a coat}

(a) Write down the number of customers who

   (i) bought a hat,

   ………………….. **(1)**

   (ii) bought a coat only.

   ………………….. **(1)**

(b) Describe the set $H \cap C$ in words.

…………………..…………………….……………………………….…………………..…

……………...……………………..………………...…………………..……………….…..……

……………...……………...……………………...……………..…………………..………

   (1)

(c) Write down $n(H \cup C)'$

   ………………….. **(1)**

13. $m = 3^4 \times 5^3$

$n = 3^3 \times 5^2 \times 11$

(*a*) Find the Lowest Common Multiple (LCM) of *m* and *n*.

………………….. **(2)**

(*b*) Find the Highest Common Factor (HCF) of 5*m* and 3*n*.

………………….. **(3)**

14. Solve the following equation.

$$\sqrt{\frac{x^2 - 4}{3}} = 2$$

………………….. **(4)**

15. Solve the following simultaneous equations. Show clear algebraic working.
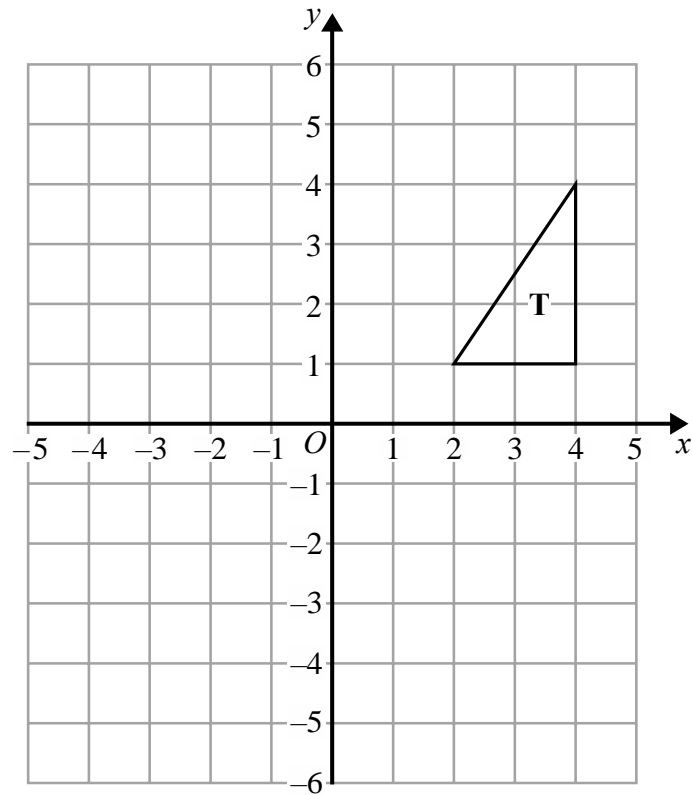
$$5x + 2y = 18$$
$$3x - 5y = 17$$

.... **(4)**

16. Solve the following equation, showing clear algebraic working.

$$\frac{3x+1}{5} - \frac{x-4}{3} = 2$$

.... **(3)**

17.

(a) On the grid above, rotate triangle T 180° about (0, 0). Label this shape with the letter A.

(2)

(b) On the grid above, translate shape T by the vector $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$. Label this shape B.

(2)

(c) On the grid above, reflect shape T in the line $y = x$. Label this shape C.

(2)

18. Line **A** has equation $3x - 4y = 5$

Line **B** goes through the points $(3, 6)$ and $(-1, 3)$

Determine if the lines **A** and **B** parallel, perpendicular or neither.
Show your working clearly and give a reason for your answer.

…………………………..……………..……………..…………….. **(4)**

19. Make p the subject of the formula $\quad t = \dfrac{5 - 3p}{2p + 4}$

………………….. **(4)**

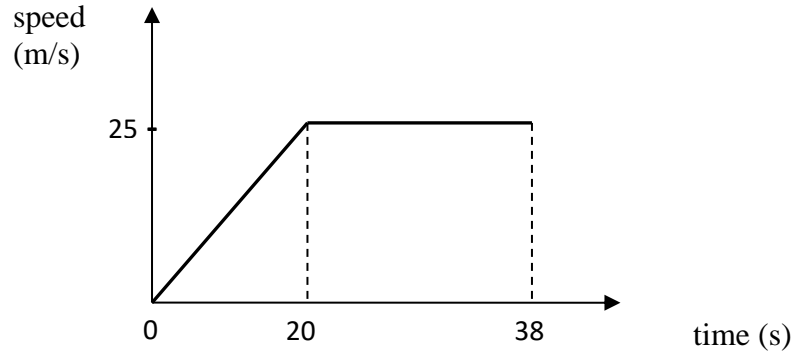**20.** The speed-time graph of a car during the first 38 seconds of its motion is shown below.

speed (m/s)

Diagram not accurately drawn

25

0   20   38   time (s)

(a) Find the distance travelled in the first 24 seconds of its motion.

………………….. **(2)**

(b) Find the acceleration of the car when $t = 15$ seconds.

………………….. **(2)**

(c) Find the total distance travelled.

………………….. **(2)**

(d) Hence, find the average speed of the car in km/h giving your answer correct to 3 significant figures.
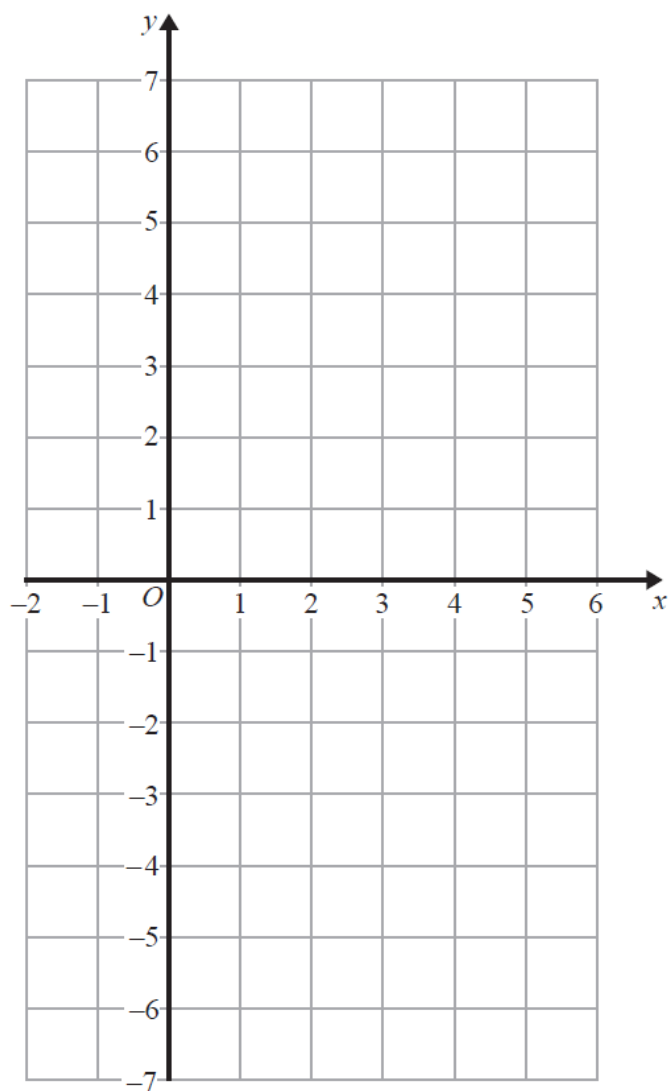
………………….. **(2)**

13

21. Show by shading on the grid, the region defined by all three of the inequalities
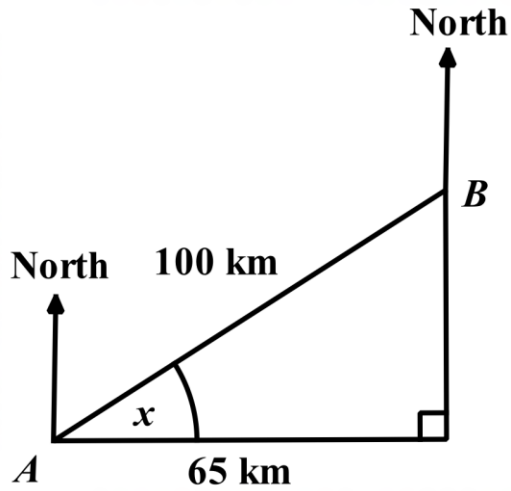
$$x > 2$$
$$y \geq -5$$
$$y \leq -x + 1$$

Label your region **R**.

(4)

22. The diagram shows the positions of two towns, *A* and *B*.

North

Diagram NOT accurately drawn

B

North   **100 km**

x

A   **65 km**

The distance from *A* to *B* is 100 km.
B is 65 km east of *A*.

(a) Work out the size of angle *x*.
    Give your answer correct to 1 decimal place.

..………………….. **(2)**

(b) Work out the bearing of *A* from *B*.
    Give your answer correct to the nearest degree.

..………………….. **(2)**

23. The cumulative frequency table shows information about the times, in minutes, 80 people waited at an airport.

Time (*t* minutes)	Cumulative frequency
$0 < t \leq 20$	5
$0 < t \leq 40$	18
$0 < t \leq 60$	42
$0 < t \leq 80$	66
$0 < t \leq 100$	78
$0 < t \leq 120$	80

(a) On the grid on the next page, draw a cumulative frequency graph for the table.
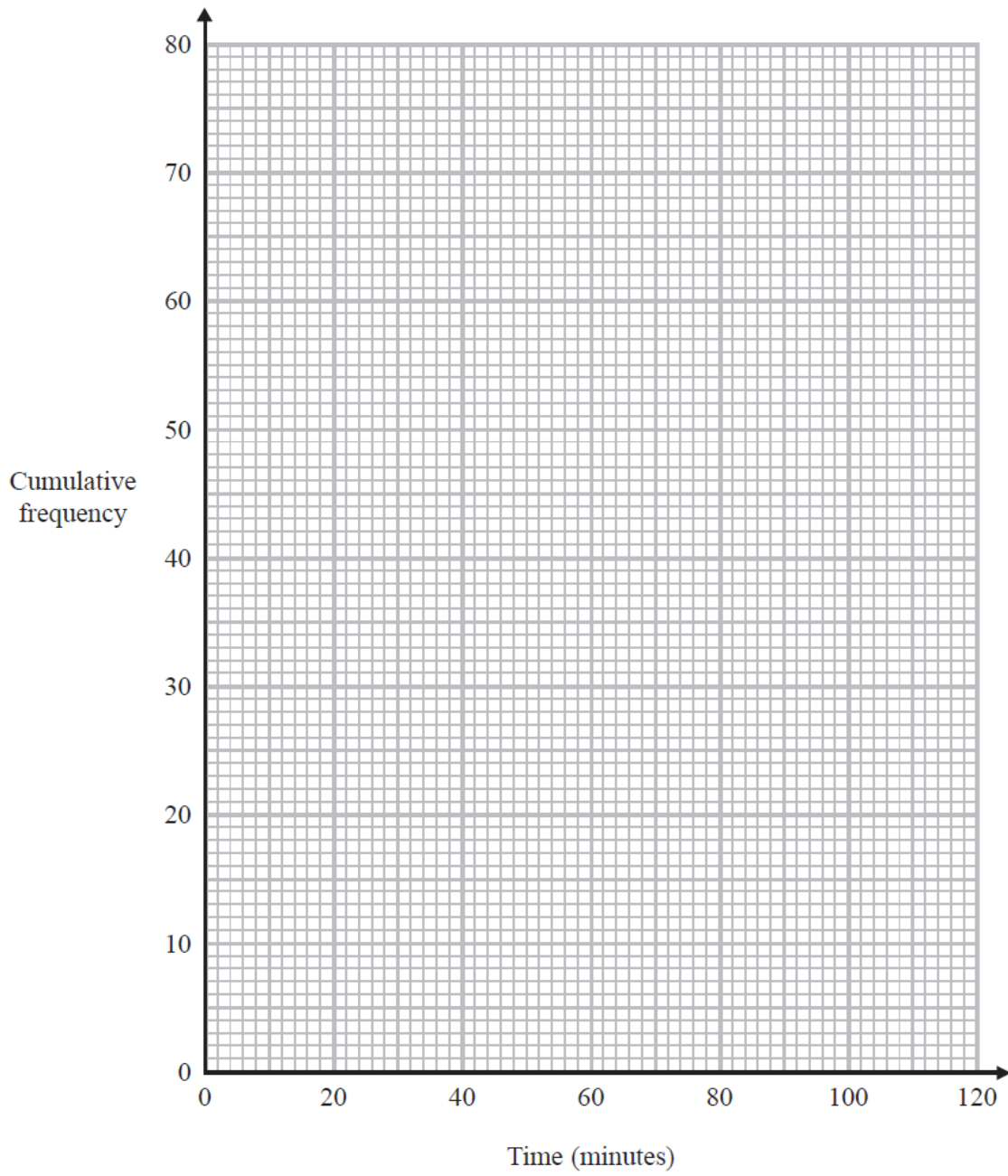
(2)

(b) Use your graph to find an estimate for the Interquartile Range.

………………….. **(3)**

(c) Use your graph to find an estimate for the number of these people who waited more than $1\dfrac{1}{2}$ hours at the airport.

………………….. **(2)**

16

Cumulative frequency

Time (minutes)

24. There are 10 people in a lift.

These 10 people have a mean weight of 79.2 kg.

3 of these people get out of the lift. These 3 people have a mean weight of 68 kg.

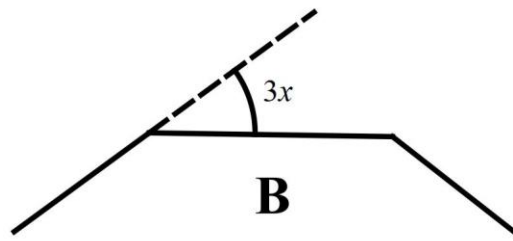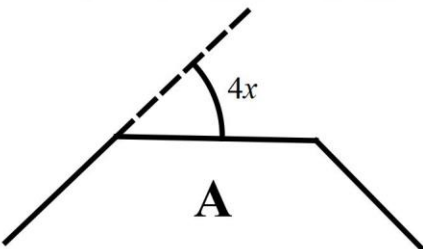Work out the mean weight of the 7 people left in the lift.

………………….. **(3)**

---

25. The diagram shows parts of two regular polygons A and B.
Polygon A has 15 sides and an exterior angle of $4x$.
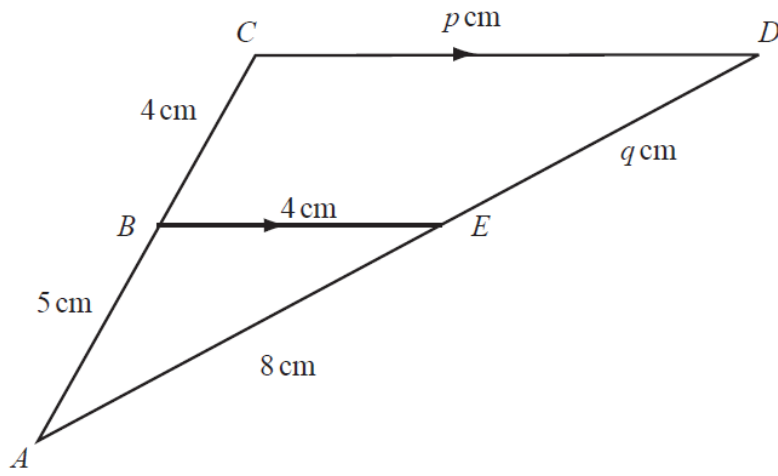Polygon B has n sides and an exterior angle of $3x$.
Work out the value of n.

………………….. **(4)**

26.

   (a) Prove that triangle *ABE* and *ACD* are similar.

                                                       (3)

   (b) Find p

                                         ………………….. **(2)**

   (c) Find q

                                         ………………….. **(2)**

END OF PAPER