YEAR 9 ENTRANCE AND SCHOLARSHIP EXAMINATION

Mathematics Specimen

Your Last Name	
Your First Name	
Your Current School	
Candidate Number	

Time allowed for this paper: 1 hour 30 mins

Instructions
- Attempt all the questions.
- Calculators may be used.
- Show all your working on this paper.
- There are 100 marks available in total for this paper.
- You must not write in the squares on the bottom right of each page.
- The marks available for each part of a question are given in square brackets.

1. Use your calculator to work out the value of

$$\frac{23 + 1.6^2}{\sqrt{43 - 2.5^3}}$$

(a) Write down the first 10 digits shown on your calculator.

Answer: _____ [1]

(b) Write your answer to (a) rounded to 3 decimal places.

Answer: _____ [1]

(c) Write your answer to (a) rounded to 2 significant figures

Answer: _____ [1]

Page Total

2. (a) A car was bought on January 1st 2010 for £16,000. By January 1st 2011, its value had fallen by 20%.

(i) Calculate the value of the car on January 1st 2011.

Answer: £_____ [1]

(ii) In each subsequent year, the value of the car fell by 15%. Calculate its value on January 1st 2013.

Answer: £ _____ [2]

(b) A rare postage stamp was bought for £300 in 1980. Its value at that time was just 12% of its current value. Calculate the current value of the stamp.

Answer: £ _____ [2]

Page Total

3.   Below is a sequence of numbers:

$$5, \quad 8, \quad 11, \quad 14, \ldots$$

(a)   Calculate the 10th term.

Answer: _____ [1]

(b)   Calculate the 75th term.

Answer: _____ [2]

(c)   David saves 5p on Sunday 1st December, 8p on Monday 2nd December, 11p on Tuesday 3rd December, and so on according to the sequence above. Calculate the day and date on which David will save 77p.

Day: _____

Date: _____ [3]

Page Total

4.   a)   Adam and Brian share £544 in the ratio 7 : 9. How much does Brian receive?

Answer: £ _____ [2]

b)   Last month a local shop found that its total revenue from selling calculators and pens could be expressed in the ratio $c : p$. That total revenue was £150, with the greater portion coming from calculator sales. In terms of c and p, what is the difference between the revenues for calculators and pens?

Answer: _____ [2]

c)   Given that $a : b = 5 : 32$ and $b : c = 24 : 31$, find the ratio $a : b : c$, giving your answer where a, b and c are whole numbers.

Answer: _____ [3]

Page Total

5.   Simplify the following:

(a) $8ab - 11a + 14b + 12a - 5ba - b$

Answer: _____ [2]

(b) $7(2 - 4x)$

Answer: _____ [1]

(c) $6t - 4(2t - 5) + 8$
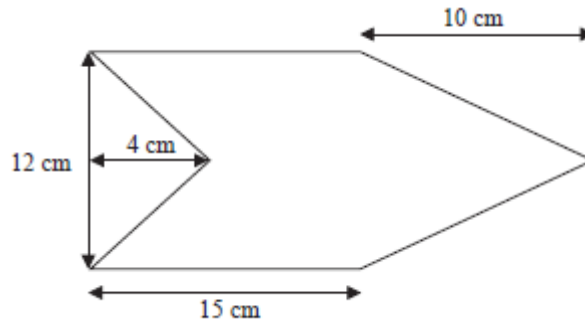
Answer: _____ [2]

(d) $(y - 3)(2y + 9)$

Answer: _____ [2]

(e) $\dfrac{36a^3b^2}{24a^4bc}$

Answer: _____ [2]

Page Total

6.   The diagram, which is not drawn to scale, shows a shape with one line of symmetry.

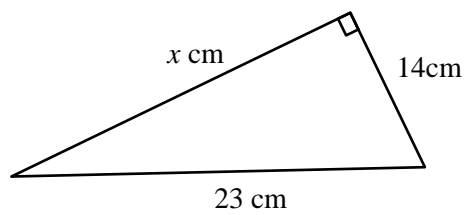

Calculate the area of this shape.

Answer: _____ cm^2 [3]
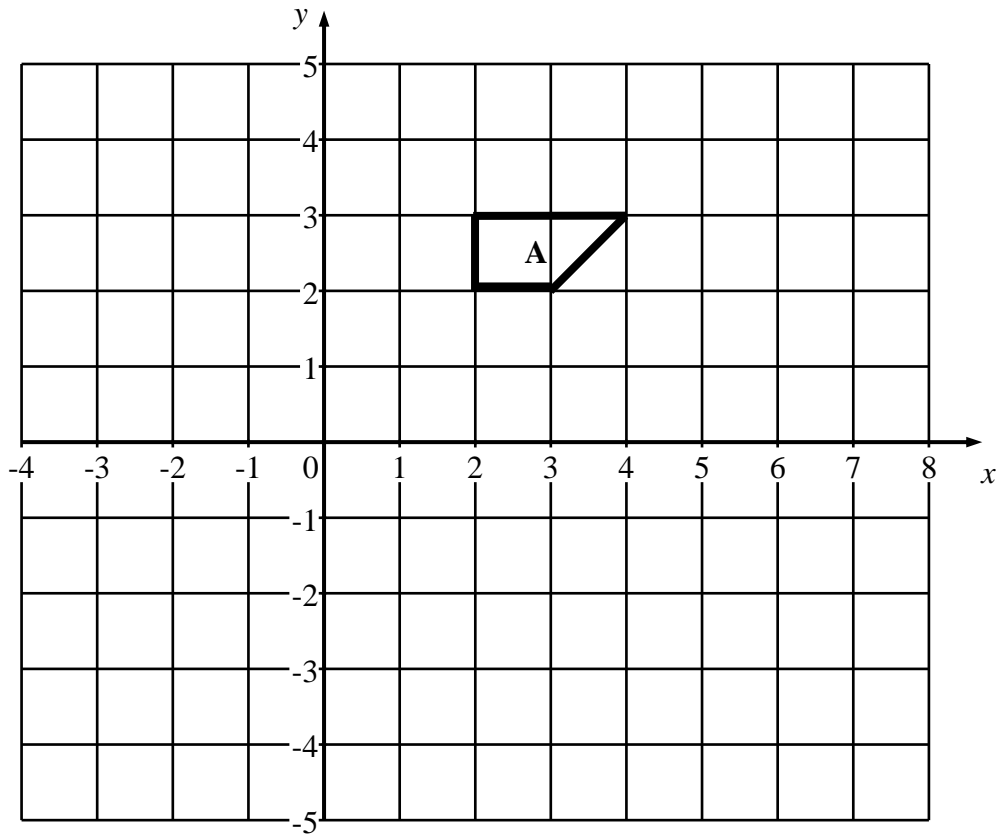
_____

7.   Calculate the length of the side marked x, giving your answer correct to 2 decimal places.

Answer: _____cm [2]

Page Total

8. (a) On the axes below, draw the line given by the equation $y = 2 - x$.

[2]

(b) Reflect shape **A** in the line $y = 2 - x$ and label that reflection B.

[2]

(c) Rotate shape **A** through 90° in the clockwise direction about the point $(4,1)$ and label the resulting shape C.

[2]

Page Total

9. Solve the following equations for x:

(a) $4(x + 5) = 2x + 10$

Answer: $x =$_____ [2]

(b) $2x(3x + 7) - 12 = x(6x + 10)$
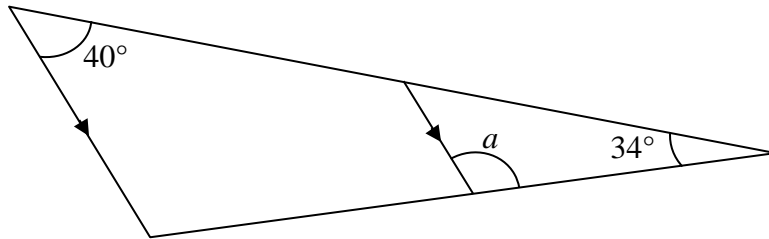
Answer: $x =$_____ [3]

(c) $8 - \frac{5x}{3} = 2$

Answer: $x =$_____ [2]
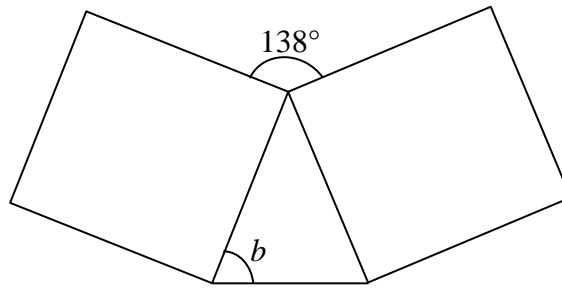
(d) $\frac{16}{2x-1} + 7 = 11$

Answer: $x =$_____ [3]

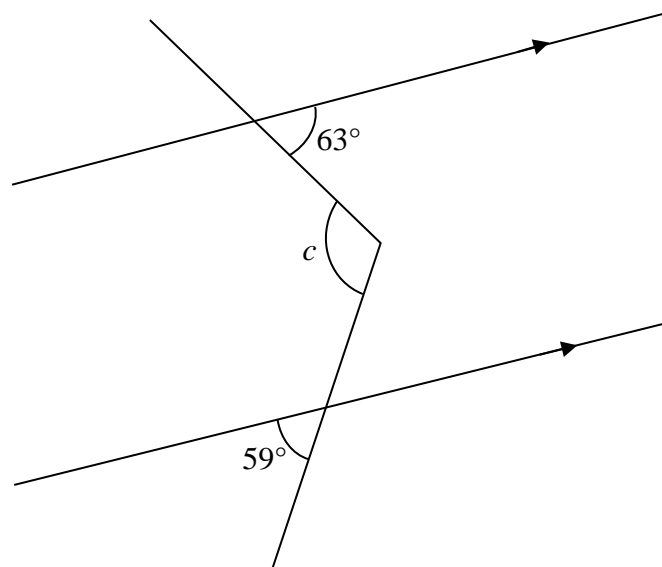| Page Total |
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10. Find the values of a, b and c in the diagrams below.

(a)

Answer $a =$_____° [2]

(b) The diagram below shows two identical squares meeting at one of their corners.

Answer $b =$_____° [2]

(c)

Answer $c =$_____° [3]

11. Factorise the following expression fully:

$$9c + 3c^3d - 12c^2d$$

Answer: _____ [2]

_____

12. While taking part in a 10 km race, a runner completed the first 6500 m in 26 minutes.

(a) Calculate the average speed of the runner, in km per hour, over this section of the course.

Answer: _____ km/hr [2]

The runner's target was to complete the entire race is under 40 minutes. For the remaining 3500 m his average speed was 16 km per hour.
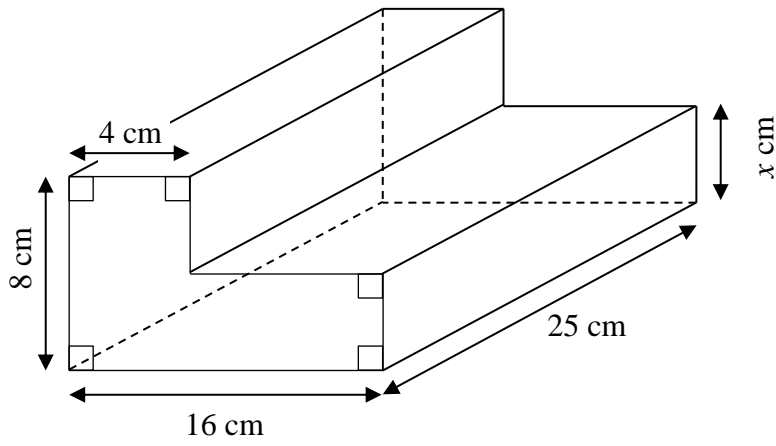
(b) **Show your working and conclusion clearly**, determine whether the runner was successful in achieving his target.

Circle one: Successful   Not successful [4]

Page Total

13. The volume of the prism below is 2450 cm^3.

Calculate the length marked x in the diagram.

Diagram **NOT** drawn to scale

4 cm

8 cm

16 cm

25 cm

x cm

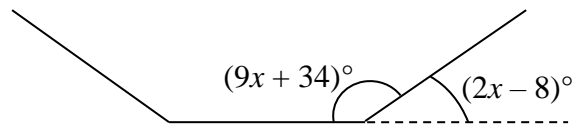Answer: _____ cm [4]

Page Total

14.   1 gallon = 3.785 litres
                              1 cubic inch = 0.0164 litres

Convert 2.5 gallons to cubic inches, giving your answer to 2 decimal places.

Answer: _____ cubic inches [3]

15.   The diagram below, which is not drawn to scale, shows three sides of a regular polygon with n sides. Work out the value of n.

$(9x + 34)°$ $(2x – 8)°$

Answer: _____ [3]

16.   The mean of 8 numbers is *m*. When one of these numbers is discarded, the mean of
        the remaining 7 numbers falls to *m* - 4. In terms of *m*, what was the value of the
        discarded number?

Answer: _____ [3]

17. A palindromic number is a number that remains the same when its digits are reversed. Examples are 27572 and 5826285.

If S is the set of all whole numbers greater than 100 and less than 301, and one whole number is randomly selected from S:

(a) what is the probability that the selected number is palindromic?

Answer: _____ [2]

(b) what is the probability that the selected number is palindromic or even?

Answer: _____ [2]

(c) If this process of selection was repeated 500 times, how many times would you expect to select a palindromic number?

Answer: _____ [1]

Page Total

18. Given that a, b, c and d are points on the number line such that

- $a > b$
- b is halfway between a and c
- the distance between a and d is three times the distance between a and c
- $d < c$,

calculate the value of $\dfrac{c-b}{b-d}$.

Answer: _____ [3]

19. Jack spends half of his money and gives one fifth of what remains to his friend. Jack is then left with £24. How much money did he start with?

Answer: £_____ [2]

_____

20. The operation $*$ is defined as

$$a * b = \begin{cases} a - b & \text{if } a \geq b \\ 0 & \text{if } a < b \end{cases}$$

(a) Evaluate $\frac{9}{16} * \frac{3}{8} + \frac{4}{7} * \frac{13}{21} + \frac{4}{5} * \frac{3}{4}$.

Answer: _____ [2]

(b) Given that $t < 0$, simplify $3t * 8t + 10t * 7t - 2t * 3t$.

Answer: _____ [2]

Page Total

21. The diagram below shows five identical circles, each with radius r cm. A square is formed with its vertices (corners) at the centres of the four outer circles and the inner circle just touches each of the four outer circles. The **unshaded** area inside the square is $(72 - 18\pi)$ cm^2.

Showing clear working, calculate the radius r of each circle.
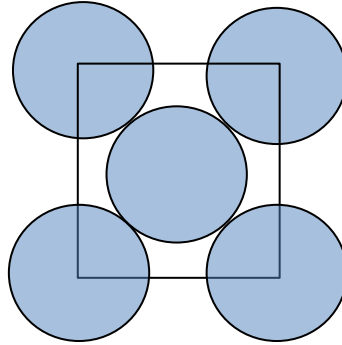
Answer: _____cm [4]

22. When written out in full, how many digits are there in the number $16^{250} \times 25^{500}$?

Answer: _____ [3]
_____

END OF THE EXAMINATION
GO BACK AND CHECK YOUR ANSWERS