

Secondary 4 E Mathematics

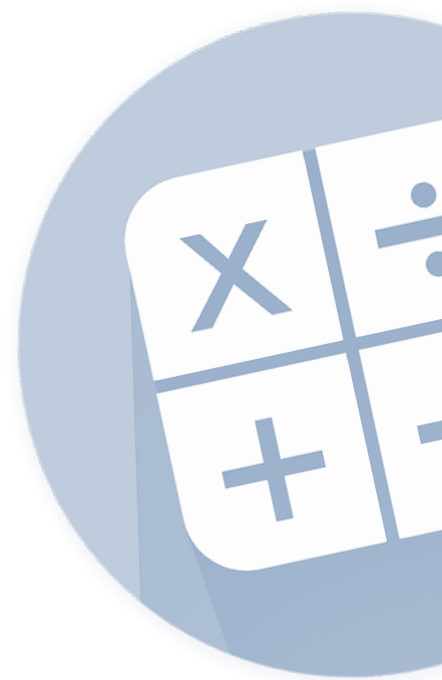
# 0 level paper 2 Common topics

Name: \_\_\_\_\_

Weeks: \_\_\_\_\_



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Difficult Questions & Tips



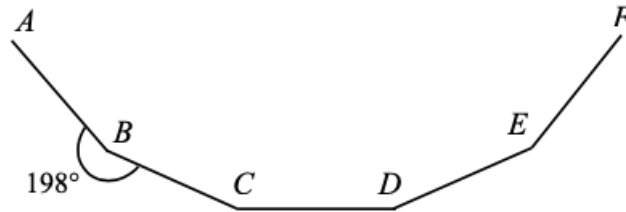
# Emaths Paper 2

## 1. Polygons

- a) A polygon has  $n$  sides. Two of its exterior angles are  $55^\circ$  and  $65^\circ$ .  
The remaining  $(n - 2)$  interior angles are each  $156^\circ$ . Calculate the value of  $n$ .

$n =$  \_\_\_\_\_ [2]

b)



The diagram shows part of a regular  $n$ -sided polygon, ABCDEF....

Given that the reflex angle  $ABC = 198^\circ$

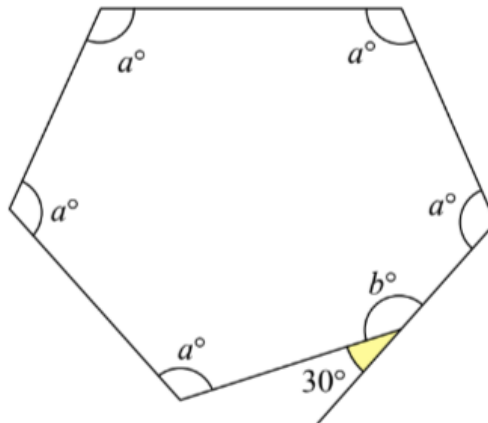
- a) Prove that triangles ABC and triangle CDE are congruent. [2]

- b) Find the size of each exterior angle. [1]

c) Find the value of  $n$ . [1]

d) Find the angle BEF. [2]

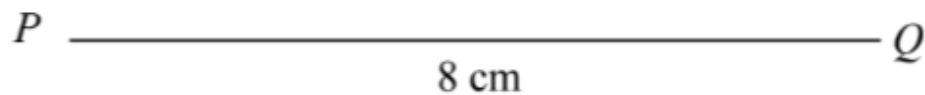
c) In the given 6-sided polygon,  $30^\circ$  is an exterior angle. Given that one of the interior angles is  $b^\circ$  and each of the remaining 5 angles is  $a^\circ$ , find the value of  $a$ . [1]



## 2. Construction

For the following geometric constructions, show your construction lines clearly, using a ruler, compass, set square and a protractor. The line PQ has been drawn for you.

- a) Construct a parallelogram PQRS such that  $PQ = RS = 8$  cm,  $PS = QR = 6$  cm and  $\angle PQR = 50^\circ$ . [3]
- b) Find the two possible positions of A and label them as  $A_1$  and  $A_2$  if  $RA = 5.9$  cm and  $\angle SPA = 150^\circ$  [2]
- c) On the parallelogram PQRS, construct;
  - I. The angle bisector of angle PSR
  - II. The perpendicular bisector of line PS
  - III. Label a possible position of point C where C is equidistant from point P & S and nearer to PS than SR.
  - IV. Measure the length of PC and angle QPC



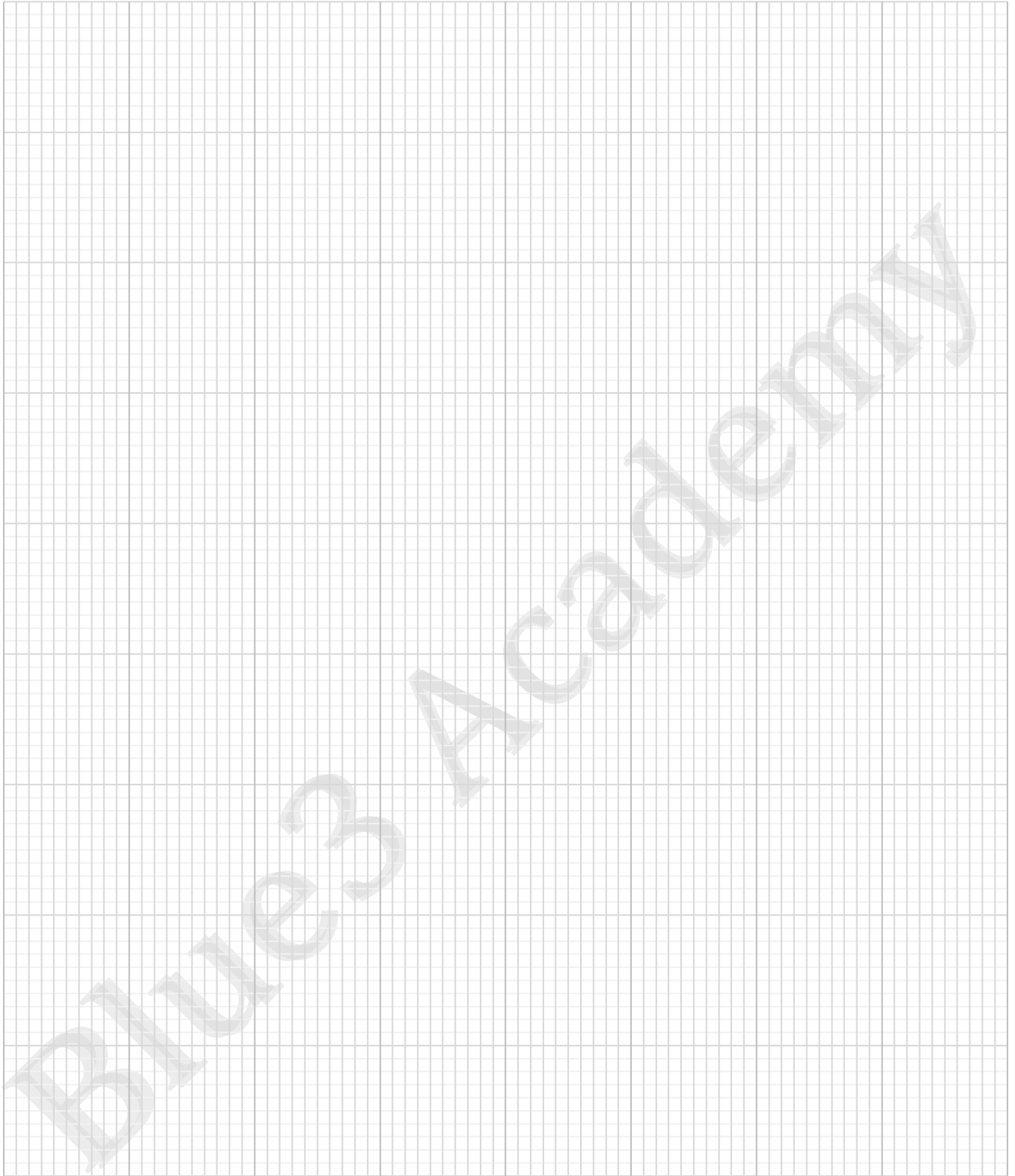
## 3. Graph

The variables  $x$  and  $y$  are related by the equation  $y = x^3 - 4x^2 + 15$ .

Some corresponding values of  $x$  and  $y$  are given in the table below.

$x$	-2	-1	0	1	2	3	4	5
$y$	-9	10	15	12	$p$	6	15	40

- a) Find the value of  $p$ . [1]
- b) Using a scale of 2 cm to represent 1 unit, draw a horizontal  $x$ -axis for  $-2 \leq x \leq 5$ . [3]  
Using a scale of 2 cm to represent 5 units, draw a vertical  $y$ -axis for  $-10 \leq y \leq 40$ .  
On the grid given, draw the graph of  $y = x^3 - 4x^2 + 15$ .
- c) By drawing a tangent, find the gradient of the graph at  $x = 4$ . [2]
- d) Use your graph to solve the equation  $x^3 - 4x^2 + 15 = 10$  for  $-2 \leq x \leq 5$  [2]
- e) i) On the same grid, draw the line  $y = 7x$  for  $0 \leq x \leq 5$  [1]
- ii) The  $x$ -coordinates of the points where this line intersects the curve are the solutions of the equation  $x^3 + Ax^2 + Bx + 15 = 0$ . [2]  
Find the value of  $A$  and  $B$ .
- iii) Write down an inequality in  $x$  to describe the range of values where  $x^3 - 4x^2 + 15 < 7x$



## 4. Probability / Quadratic Equations

There are only red and blue pens in a box.

There are three more blue pens than red pens in the box.

There are more than 12 pens in the box.

Sue randomly takes two pens, without replacement, from the box.

- a) Given the number of red pens in the box is  $x$ . [1]

Write down, in terms of  $x$ , the probability of taking two red pens from the box.

- b) Write down, in terms of  $x$ , the probability of taking two blue pens from the box. [1]

- c) The probability that Sue will take two pens of the same colour is  $\frac{27}{55}$ . [3]

Write down an equation to represent this information and show that it reduces to

$$x^2 - 25x + 84 = 0$$

- d) Solve the equation  $x^2 - 25x + 84 = 0$ . [3]

e) Explain why one of the solutions in part (d) must be rejected. [1]

f) Find the total number of pens in the box. [1]

### 5. Matrices

A concert is open for afternoon and evening performances for two days each week. Each performance has tickets sold in three sections, A, B and C.

The matrix  $N$  shows the number of tickets sold in each section in week 1.

$$N = \begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} \text{afternoon} \\ \text{evening} \end{matrix} & \begin{pmatrix} 50 & 85 & 106 \\ 55 & 102 & 130 \end{pmatrix} \end{matrix}$$

a) The price of each ticket is \$50 for Section A, \$30 for Section B and \$20 for Section C. Represent the costs in a  $3 \times 1$  column matrix  $P$ . [1]

b) Evaluate the matrix  $E = NP$  [2]



- c) State what each element of Matrix **E** represents [1]
- d) Calculate the total amount collected in sales from the concert performances in week 1. [1]
- e) In week 2, there was an initiative to reserve and only attract student audience to the afternoon concert performance by offering a 75% subsidy on the price of each ticket. [3]

This initiative resulted in a 200% increase in the number of tickets sold in Section A, 100% increase in the number of tickets sold in Section B and 50% increase in the number of tickets sold in Section C.

Using matrix multiplication, calculate the total amount collected in sales from the afternoon concert performances in week 2.

## 6. Proportion

It is given that  $p$  is inversely proportional to the square of  $q$ . It is known that  $p = 18$  for a particular value of  $q$ . When  $q$  is increased by 200%, find

a) The value of  $p$ . [2]

b) The percentage decrease in the value of  $p$ . [2]