



# Coimisiún na Scrúduithe Stáit State Examinations Commission

**JUNIOR CERTIFICATE EXAMINATION, 2009**

**MATHEMATICS – HIGHER LEVEL**

**PAPER 1 (300 marks)**

**THURSDAY, 4 JUNE – MORNING, 9:30 to 12:00**

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Attempt **ALL** questions.

Each question carries 50 marks.

**Graph paper may be obtained from the superintendent.**

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The symbol  indicates that supporting work **must** be shown to obtain full marks.

1. (a) In a school library, 28% of the books are classified as fiction and the remainder as non-fiction.

There are 3240 non-fiction books in the library.

-  Find the number of books which are classified as fiction.



- (b) (i)  Given that  $x = 2 \times 10^{-3}$  and  $y = 7 \times 10^{-4}$ , evaluate  $x + 8y$ .

Express your answer in the form  $a \times 10^n$ , where  $n \in \mathbb{Z}$  and  $1 \leq a < 10$ .

- (ii) A supermarket has a special offer on three different brands of packets of soap.

The following table gives details of the offer:

Brand	No. of bars per packet	Weight of each bar	Price of packet
A	3	100g	€1.35
B	6	100g	€2.40
C	4	125g	€2.38

-  Which brand has the cheapest price per gram?

- (c) A man travels from Arklow to Blanchardstown, a distance of 90 km. He leaves Arklow at 09:25 and arrives in Blanchardstown at 10:55.

- (i)  Calculate his average speed for the journey.

He continues from Blanchardstown to Cootehill, a distance of 112 km. He increases his average speed by 4 km/h for this section of his journey.

- (ii)  At what time does he arrive in Cootehill?

2. (a) Eight workers can build a cabin in 60 hours.

 How many workers are needed if the cabin is to be built in 32 hours?



- (b) A group of 49 students was asked which fruit each liked.

28 said they liked apples. 25 said they liked pears while 26 said they liked oranges.  
8 said they liked all three types of fruit.

17 said they liked pears and oranges. 11 said they liked apples and oranges.

5 said they did not like any of the three types of fruit.

Let  $x$  represent those students who liked apples and pears but not oranges.

- (i)  Represent the above information on a Venn diagram.  
(ii)  Calculate the value of  $x$ .  
(iii)  Calculate the percentage of students who liked one type of fruit only.

Give your answer correct to the nearest whole number.



- (c) Three business partners, Aideen, Brian and Caroline, invest €30 000, €40 000 and €70 000 respectively. At the end of each year, 22.5% of the profit made is placed in reserve and the remainder is divided among the partners in proportion to their investments.

(i)  Given that in 2007, the profit amounted to €12 880, calculate the amount placed in reserve.

(ii)  In 2008, Caroline's portion of the profit was €9331. Calculate how much Aideen and Brian each received in 2008.

(iii)  Calculate the amount placed in reserve in 2008.

**3.** (a)  Simplify:

$$(2x - 3)(4 - 5x).$$

(b) (i)  Given that  $x = 2t - 1$  and  $y = \frac{2}{3}t + 2$ , express  $3x - y + 2$  in terms of  $t$ , in its simplest form.

(ii)  Hence, find the value of  $t$  when  $3x - y + 2 = 0$ .

(c) A swimming pool can be filled by a large pipe operating alone in 4 hours.

(i) What fraction of the pool can be filled by this pipe in 1 hour?

The swimming pool can be filled by a small pipe operating alone in  $x$  hours.

(ii)  Derive an expression in  $x$  for the fraction of the pool filled by the two pipes working together in 1 hour.

It takes 3 hours for the two pipes working together to fill the pool.

(iii)  Find  $x$ .



4. (a) Given that  $y = \sqrt{2x - a}$ ,  
find the value of  $y$  when  $x = 4$  and  $a = -1$ .

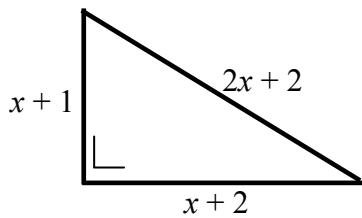
- (b) (i) Graph on the number line the solution set of  
 $-3 < 4x + 7 \leq 23, x \in \mathbf{R}$ .

- (ii) Solve the following simultaneous equations:

$$x = -\frac{1}{2}y + 36$$

$$y = 2x + 12.$$

- (c) The lengths of the sides of a right-angled triangle are as shown in the diagram.



- (i) Using the theorem of Pythagoras, write an equation in  $x$ .  
(ii) Solve this equation to find  $x$  correct to 2 decimal places.

- 5.** (a) Given that  $f(x) = 5x - 12$  and that  $f(a) = a$ , find the value of  $a$ .
- (b) (i) Let  $f$  be the function  $f: x \rightarrow 5x - 4$  and  $g$  be the function  $g: x \rightarrow 3x + 1$ .  
Using the same axes and scales, draw the graph of  $f$  and the graph of  $g$ , for  $0 \leq x \leq 3$ ,  $x \in \mathbf{R}$ .
- (ii) From your graphs, write down the co-ordinates of the point of intersection of the two lines.
- (c) Let  $f$  be the function  $f: x \rightarrow 2x^2 + x - 15$ .  
(i) Draw the graph of  $f$  for  $-4 \leq x \leq 3$ ,  $x \in \mathbf{R}$ .  
(ii) Use your graph to find the minimum value of  $f(x)$ .  
(iii) Use your graph to find the range of values of  $x$  for which  $f(x) \geq 0$ .

**6.** (a)  Express in its simplest form:

$$\frac{x+7}{5} + \frac{3-x}{4}.$$

(b) (i) Factorise  $25x^2 - 36y^2$ .

(ii) Factorise  $11x^2 + 75x - 14$ .

(iii)  Simplify  $(3-4x)^2 - (3-5x)^2$ .

(c) (i)  Solve  $\frac{6}{x} + \frac{6}{x+2} = \frac{5}{2}$ ,  $x \in \mathbf{R}$ .

(ii)  Hence, or otherwise, find the two values of  $t \in \mathbf{R}$ , for which

$$\frac{6}{2t-1} + \frac{6}{2t+1} = \frac{5}{2}.$$

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