

Independent Schools  
Examinations Board

## COMMON ENTRANCE EXAMINATION AT 13+

# MATHEMATICS III

Thursday 30 May 2002

Please read this information before the examination starts.

- This examination is 60 minutes long.
- Answer as many questions as possible. They may be done in any order.
- **Failure to show necessary working may result in loss of marks.**
- Electronic calculators may be used in any question.
- Candidates are expected to give answers to an appropriate degree of accuracy.
- Solutions to questions which require accurate drawing should be done on graph or squared paper.

1. (a) Find the value of

$$\frac{\frac{1}{2} + \frac{1}{3}}{\frac{1}{2} \times \frac{1}{3}}$$

(3) ✗

(b) If  $3a^2 + b^2 = 144$  and  $a$  and  $b$  are both positive, find

(i) the value of  $b$  when  $a = 4$

(2)

(ii) the value of  $a$  when  $a = b$

(3)

(c) If  $\frac{cd}{c+d} = 2$  find the value of  $c$  when  $d = 3$

(3)

(d) Mr Newton goes to see *Pythagoras – the movie* at the cinema. The seat numbers available satisfy both the following inequalities:

$$5x - 66 < 24$$

$$\text{and } \frac{1}{2}(x - 1) \geq 5$$

(i) Solve each inequality.

(5)

Mr Newton is given one of the available seats chosen at random.

(ii) What is the probability that he is given an even numbered seat?

(4)

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2. (a) Jason organises a paintball competition for a large group of people.

When he starts to sort them out, he notices that

- (a) he will need two buses, each able to carry up to 40 people  
and (b) he can divide the group exactly by 3, 4 or 5

(i) How many people are there in the group? (2)

Jason wishes to divide the group into teams of equal size. There must be an even number of teams and each team must have at least 10 people.

(ii) List the team sizes into which he could divide them exactly. (2)

The day before they are due to go, 8 people tell Jason that they may possibly be unable to attend, so he asks 8 other people who all agree to turn up. Everyone else confirms their attendance.

(iii) What is the largest number of people who could turn up for the competition? (1)

When everyone arrives, he notices that

- (a) he can still divide by 3  
but (b) when he divides by 5, he has 1 person left over.

(iv) How many people actually went paintballing? (2)

(v) List the team sizes into which Jason can divide them exactly. (2)

(b) Judith takes part in a mini-biathlon.

First she swims for 15 minutes at 2 km per hour.

(i) How far does she swim? (2)

Then she runs 10 km at 15 km per hour.

(ii) How long does she take to do the run? (2)

(iii) Find Judith's average speed for the whole mini-biathlon. (3)

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3. In a cake shop, Susan notices a sign saying:

Two doughnuts and one muffin for only 84p

If the cost of a doughnut is  $d$  pence and the cost of a muffin is  $m$  pence,

(i) write down an equation relating  $d$  and  $m$ .

(2)

Peter tells Susan that a doughnut costs 6 pence more than a muffin.

(ii) Write down another equation relating  $d$  and  $m$ .

(2)

(iii) Solve your equations to find the values of  $d$  and  $m$ .

(4)

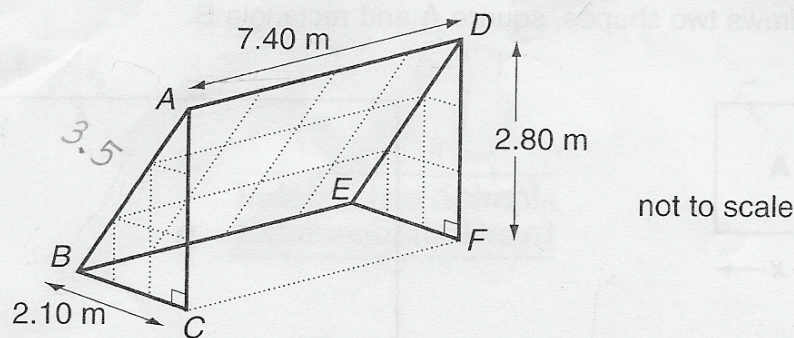
Susan has a party at which there are 20 people. 7 of them prefer doughnuts, 8 prefer muffins and the rest do not mind. The cake shop has a special offer:

Pack of 4 doughnuts only £1    Pack of 5 muffins only £1

(iv) If single doughnuts and muffins still cost the amounts you found in part (iii), what is the cheapest price which Susan can pay for her party cakes?

(6)

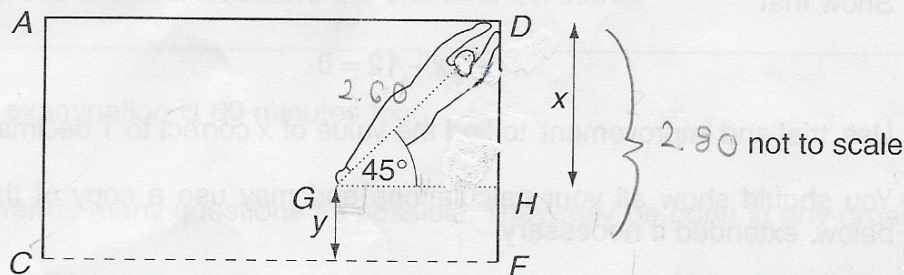
4.



The diagram shows a football goal with the netting in place. The posts are vertical and the netting is taut.

- (i) Calculate the length  $AB$ .  $3.5$  (3)
- (ii) Calculate the area of the side netting  $\triangle ABC$ .  $\frac{1}{2}(2.10)(2.80) = 2.94$  (2)
- (iii) Calculate the area of netting used for the goal.  $2(2.94) + 3.5(7.40) = 31.78$  (4)
- (iv) Calculate the volume of air enclosed within the goal. (2)

$2.95(7.40) = 21.83$



The diagram shows the goalkeeper diving at full stretch to touch the top corner. His full height  $GD$  is 2.60 metres.

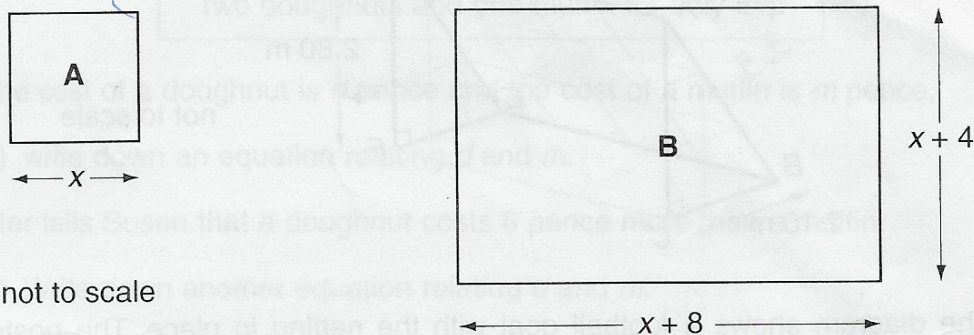
If in this position he is at  $45^\circ$  to the ground,

- (v) state another length equal to  $DH$   $GH$  (1)
- (vi) use Pythagoras' theorem in  $\triangle DGH$  to calculate  $x$   $x = 1.838$  (4)
- (vii) find  $y$ , the height of his feet off the ground. (1)

$2.80 - 1.838 = 0.962 \text{ m}$

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5. Jenny draws two shapes, square **A** and rectangle **B**.



(i) Find, in terms of  $x$ ,

(a) the area of the square

(1)

(b) the perimeter of the rectangle.

(2)

(ii) Jenny notices that the perimeter of the rectangle is twice the area of the square.

Show that

$$x^2 - 2x - 12 = 0$$

(2)

(iii) Use 'trial and improvement' to find the value of  $x$  correct to 1 decimal place.

You should show all your calculations and may use a copy of the table below, extended if necessary.

$x$	$x^2$	$-2x$	$-12$	$x^2 - 2x - 12$
3	9	-6	-12	-9
5	25	-10	-12	3
4.5	20.25	-9	-12	-0.75

(6)

(iv) Use the value of  $x$  you have found to calculate the area of the rectangle.

(2)