TOOWOOMBA EDUCATION CENTRE

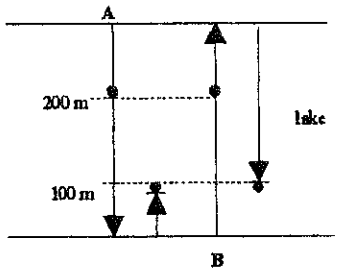
MATHEMATICS TEAM CHALLENGE 1997

TEAM EVENT: Junior Secondary **Time: 45 mins**
(Calculators are allowed) **Total: 150 points**

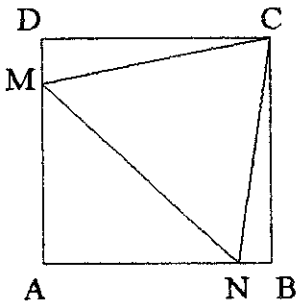
T1. (10 points) What are the next three numbers of the *Padovan* series shown below?

2, 2, 3, 4, 5, 7, 9, 12, 16, 21, ___, ___, ___

T2. (20 points) Two boats, each travelling at its own constant speed, leave at the same time from A and B respectively and travel directly across a lake. They first pass each other 200 metres from shore A and next pass each other (after each has reached and immediately left its opposite shore) 20 seconds later, 100 metres from "shore B." Compute the speed of the faster boat, in metres per second.



T3. (20 points) In the diagram below ABCD is a square and CMN is an equilateral triangle. Given the area of ABCD is one square metre, determine the area of triangle CMN.



T4. (20 points) Two identical right circular cones, each of height 2 m and radius 1 m, are placed as shown (each is vertical, apex downward). At the start, the upper cone is full of water and the lower cone is empty. Then water drips down, through a hole in the apex of the upper cone, into the lower cone. Compute the height of water in the lower cone at the moment when the height of water in the upper cone is 1 metre. (Note: Height is measured from the apex of the cone.)

T5. (15 points) Complete this "cross-number puzzle" by putting the proper digit into each box. All answers to clues are three-digit numbers (thus no answer begins with a zero).

1	2	3
4		
5		

ACROSS
1. A prime
4. A composite
5. A square

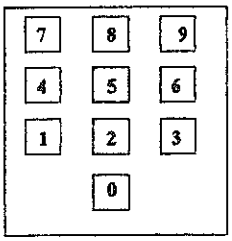
DOWN
1. An integral power of 5
2. An integral power of 2
3. An integral power of 3

T6. (10 points) If $(a + b)$: $(b + c)$: $(c + a) = 6$: 7: 8, and $a + b + c = 14$, compute the value of c.

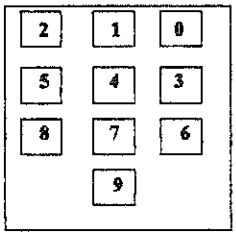
T7. (15 points) John's little sister has switched the "keycovers" on John's new calculator without telling him! The original key values and the new cover positions are shown below.

Thus when John presses the key labelled 4, the number 5 is actually entered in the calculator (and 5 shows on the display). Without noticing the display, John enters the two-digit *prime p* and the one digit *prime q* (using the numbers he sees on the keyboard) and instructs the calculator to add them. Suprisingly, the sum that shows on the display is the correct answer to John's problem! Find the ordered pair (p, q).

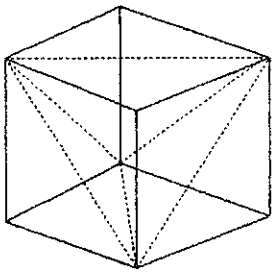
Original Position



Replaced Keycovers



T8. (15 points) Four of the eight vertices of a one metre cube are vertices of a regular tetrahedron (shown dotted). Find the ratio of the surface area of the cube to the surface area of the regular tetrahedron.



T9. (15 points) The integers greater than one are arranged in five columns as follows:

	2	3	4	5
9	8	7	6	
	10	11	12	13
17	16	15	14	
.	.	.	.	

(Four consecutive integers appear in each row; in the first, third and other odd numbered rows, the integers appear in the last four columns and increase from left to right; in the second, fourth and other even numbered rows, the integers appear in the first four columns and increase from right to left.) In which column (i.e. first, second, third, fourth or fifth) will the number 1,000 fall?

T10. (10 points) A town's population increased by 1,200 people, and then this new population decreased by 11%. The town now had 32 less people than it did before the 1,200 increase. What is the original population?

MATHS TEAMS CHALLENGE
JUNIOR SECONDARY
TEAM EVENT (1997)
ANSWER SHEET

Questions	Team Responses	Points
T1 (10points)	28, 37, 49	
T2 (20 points)	30 metres/second	
T3 (20 points)	$2\sqrt{3} - 3 = 0.464$ metres	
T4 (20points)	height = 1.913 metres	
T5 (15 points)	1 5 7 = 5 points	
	2 1 2 = 5 points	
	5 2 9 = 5 points	
T6 (10 points)	c = 6	
T7 (15 points)	(p, q) = (47,7)	
T8 (15 points)	$\sqrt{3} = 1.732$	
T9 (15 points)	second column	
T10 (10 points)	10,000	
	Total Points	

SCHOOL:

Team 1 ❑ **Team 2** ❑

MATHS TEAMS CHALLENGE
JUNIOR SECONDARY
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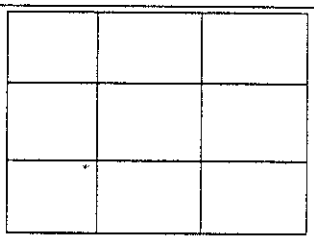
Questions	Team Responses	Points
T1 (10points)		
T2 (20 points)		
T3 (20 points)		
T4 (20points)		
T5 (15 points)		
T6 (10 points)		
T7 (15 points)		
T8 (15 points)		
T9 (15 points)		
T10 (10 points)		
	Total Points	

SCHOOL:

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