2008 TOOWOOMBA MATHEMATICS TEAM CHALLENGE

SENIOR SECONDARY

RELAY CONTEST

Time: *1 hour*
Calculators may be used
Each question is worth 5 points. Total of 100 points

R1 (5 points) (95 points remaining)

What is the largest prime factor of 8091?

R2 (5 points) (90 points remaining)

The point $(c-1, c+1)$ lies on the line $y = 2x - 3$. What is the value of c?

R3 (5 points) (85 points remaining)

A customer enters a supermarket. The probability that the customer buys bread is 0.60, milk is 0.50 and both bread and milk is 0.30. What is the probability that the customer neither buys bread nor milk?

R4 (5 points) (80 points remaining)

Twenty-eight line segments of length 1 are arranged as shown to form 9 squares. There are various routes from A to B travelling along the segments so that no segment is travelled more than once. What is the number of different routes possible?

R5 (5 points) (75 points remaining)

A function $f(x)$ has the following properties:

(i) $f(1) = 1$

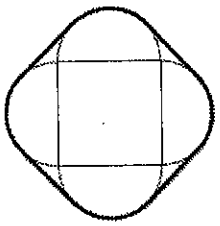
(ii) $f(2x) = 4f(x) + 6$

(iii) $f(x+2) = f(x) + 12x + 12$

Calculate $f(5)$.

R6 (5 points) (70 points remaining)

A square of side length 2 has semicircles drawn on each side. A rubber band is stretched tightly around the figure. What is the length of the rubber band band in this position?



R7 (5 points) (65 points remaining)

Five houses in a row are each to be painted with the colors red, white, and blue. In how many different ways can the houses be painted so that no two adjacent houses are the same colour?

R8 (5 points) (60 points remaining)

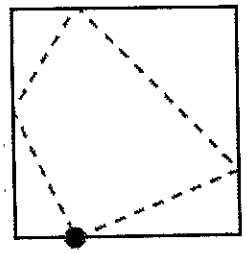
How many non-rectangular trapeziums can be formed from the vertices of a regular octagon?

R9 (5 points) (55 points remaining)

What is the sum of the prime factors of $10! = 10 \times 9 \times 8 \times \ldots \times 2 \times 1$?

R10 (5 points) (50 points remaining)

John stands against one wall of a square room with walls of length 3 metres each. He kicks a frictionless, perfectly elastic ball in such a way that it bounces off the three other walls once each and returns to him as suggested by the diagram (which is not necessarily to scale). How many metres does the ball travel?



R11 (5 points) (45 points remaining)

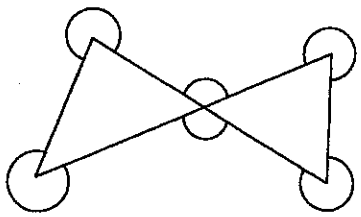
Find the volume of a regular octahedron whose vertices are at the centers of the faces of a unit cube.

R12 (5 points) (40 points remaining)

Josie goes for a run but after covering 2/3 of her route feels exhausted and walks the rest of the way. She spends twice as long walking as she did running. How many times as fast does Josie run as walk?

R13 (5 points) (35 points remaining)

What is the sum of the six marked angles?



R14 (5 points) (30 points remaining)

Last year, the ratio of boys to girls in a school was 4:3. This year, there are 50 fewer boys and 30 fewer girls in the school and the ratio of boys to girls is 5:4. What was the total number of students at the school last year?

R15 (5 points) (25 points remaining)

What is the value of $\log_{0.01} 100$?

R16 (5 points) (20 points remaining)

Determine all values of x for which $2 + \sqrt{x-2} = x - 2$.

R17 (5 points) (15 points remaining)

Two disks of radius 1 are drawn so that each disk's circumference passes through the center of the other disk. What is the circumference of the region in which they overlap?

R18 (5 points) (10 points remaining)

What is the square root of the sum of the first 2008 positive odd integers?

R19 (5 points) (5 points remaining)

A boat is traveling upstream at 5 kph relative to the current flowing against it at 1 kph. A tree branch 10 kilometres upstream from the boat falls into the current of the river. How many hours does it take to reach the boat?

R20 (5 points) (0 points remaining)

Determine the value of

$$\sum_{i=1}^{10} \sum_{j=1}^{10} |i - j|$$

TOOWOOMBA EDUCATION CENTRE

2008 MATHS TEAM CHALLENGE

Answer Sheet

SENIOR SECONDARY RELAY

Problem	Answer	Attempts √ or ×							Score	Progressive Score
		7	6	5	4	3	2	1		
R 1 (5 points)	31									
R 2 (5 points)	6									
R 3 (5 points)	0.2 or 1/5									
R 4 (5 points)	512									
Change				**Change**					**Change**	
R 5 (5 points)	73									
R 6 (5 points)										
R 7 (5 points)	48									
R 8 (5 points)	24									
Change				**Change**					**Change**	
R 9 (5 points)	45									
R 10 (5 points)										
R 11 (5 points)	1/6 or 0.1674									
R 12 (5points)	4									
Change				**Change**					**Change**	
R 13 (5 points)										
R 14 (5points)	350									
R 15 (5 points)	−1									
R 16 (5 points)	6									
Change				**Change**					**Change**	
R 17 (5 points)										
R 18 (5 points)	2008									
R 19 (5 points)	2 (hours)									
R 20 (5 points)	330									
									Total	

School: _____

Team 1: ☐ **Team 2:** ☐