# AUSTRALIAN MATHEMATICS COMPETITION
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AUSTRALIAN MATHEMATICS TRUST

CommonwealthBank

NAME _____

YEAR _____ TEACHER _____

# 2013
# JUNIOR DIVISION
## AUSTRALIAN SCHOOL YEARS 7 and 8

TIME ALLOWED: 75 MINUTES

## INSTRUCTIONS AND INFORMATION

### GENERAL

1. Do not open the booklet until told to do so by your teacher.
2. NO calculators, slide rules, log tables, maths stencils, mobile phones or other calculating aids are permitted. Scribbling paper, graph paper, ruler and compasses are permitted, but are not essential.
3. Diagrams are NOT drawn to scale. They are intended only as aids.
4. There are 25 multiple-choice questions, each with 5 possible answers given and 5 questions that require a whole number answer between 0 and 999. The questions generally get harder as you work through the paper. There is no penalty for an incorrect response.
5. This is a competition not a test; do not expect to answer all questions. You are only competing against your own year in your own country or Australian state so different years doing the same paper are not compared.
6. Read the instructions on the answer sheet carefully. Ensure your name, school name and school year are entered. It is your responsibility to correctly code your answer sheet.
7. When your teacher gives the signal, begin working on the problems.

### THE ANSWER SHEET

1. Use only lead pencil.
2. Record your answers on the reverse of the answer sheet (not on the question paper) by FULLY colouring the circle matching your answer.
3. Your answer sheet will be scanned. The optical scanner will attempt to read all markings even if they are in the wrong places, so please be careful not to doodle or write anything extra on the answer sheet. If you want to change an answer or remove any marks, use a plastic eraser and be sure to remove all marks and smudges.

### INTEGRITY OF THE COMPETITION

# Junior Division

**Questions 1 to 10, 3 marks each**

**1.** $1999 + 24$ is equal to

(A) 1923 (B) 2003 (C) 2013 (D) 2023 (E) 2113

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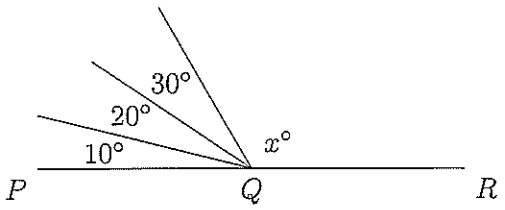
**2.** $PQR$ is a straight line. Find the value of $x$.




(A) 40 (B) 90 (C) 100 (D) 110 (E) 120

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**3.** The value of the fraction $\frac{1}{2}$ is closest to

(A) 0.45 (B) 0.6 (C) $\frac{1}{3}$ (D) $\frac{5}{8}$ (E) $\frac{2}{5}$

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**4.** Which of the following is equal to 20?

(A) $3 + 2 \times 4$ (B) $(9 + 5) \times 2 - 4 \times 2$ (C) $10^2$ (D) $20 + 20 \div 2$ (E) $10 \div 2$

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**5.** How many minutes are there between 8:37 am and 10:16 am?

(A) 39 (B) 79 (C) 99 (D) 141 (E) 179

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**6.** Three squares each with an area of $25\,\text{cm}^2$ are placed side by side to form a rectangle. The perimeter, in centimetres, of the rectangle is

(A) 20 (B) 36 (C) 40 (D) 75 (E) 100

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**7.** If every digit of a whole number is either a 3 or a 5, the number will always be

(A) divisible by 3 (B) divisible by 5 (C) prime (D) even (E) odd

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**8.** $P$ is the point at 0.56 and $Q$ is the point at 1.2 on a number line. The point which is halfway between $P$ and $Q$ is at

(A) 0.34 (B) 0.64 (C) 0.83 (D) 0.88 (E) 0.93

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**9.** If triangle $ABC$ is isosceles with $\angle A = 40°$, what are all of the possible values for $\angle B$?

(A) 40° (B) 40° and 70° (C) 40° and 100°

(D) 70° and 100° (E) 40°, 70° and 100°

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**10.** In Gwen's classroom, the desks are arranged in a grid. Each row has the same number of desks. Gwen's desk is third from the front, second from the back and has one desk to the left and four to the right. How many desks are there?

(A) 20 (B) 24 (C) 25 (D) 28 (E) 30

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## Questions 11 to 20, 4 marks each

**11.** William travels to school in two different ways. Either he walks to school and takes the bus home, or he takes the bus to school and walks home. In each case his total travelling time is 40 minutes. If he were to take the bus both ways, his total travelling time would be 20 minutes. How many minutes would it take if he walked both ways?

(A) 30 (B) 40 (C) 50 (D) 60 (E) 80

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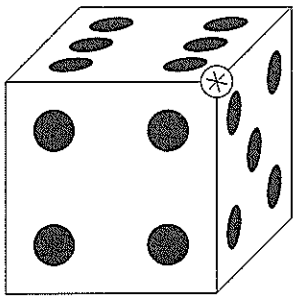
**12.** The opposite faces on a standard dice add to give a total of 7. The game of *Corners* is played by rolling a dice and then choosing a vertex of the dice with your eyes closed. For example, the score for the vertex chosen below would be $4+5+6 = 15$.



Which of the following scores is NOT possible when playing *Corners*?

(A) 6 (B) 7 (C) 8 (D) 9 (E) 10

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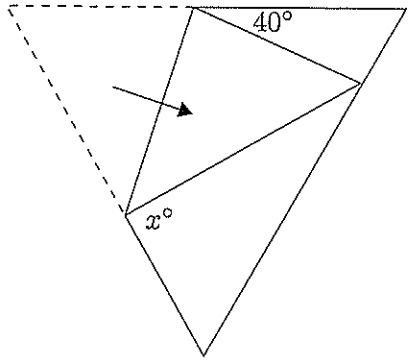
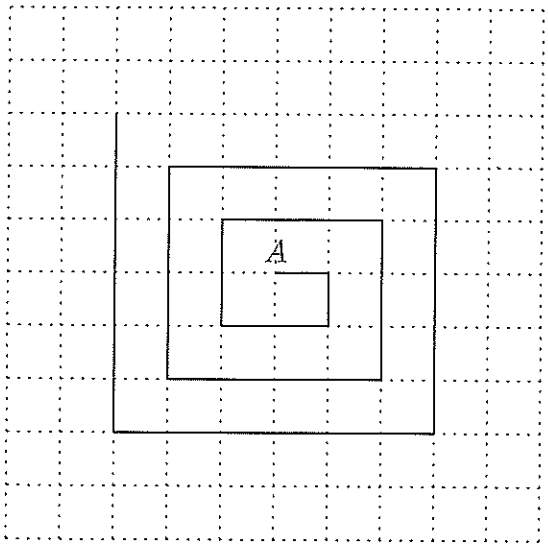
**13.** A piece of paper in the shape of an equilateral triangle has one corner folded over, as shown.




What is the value of $x$?

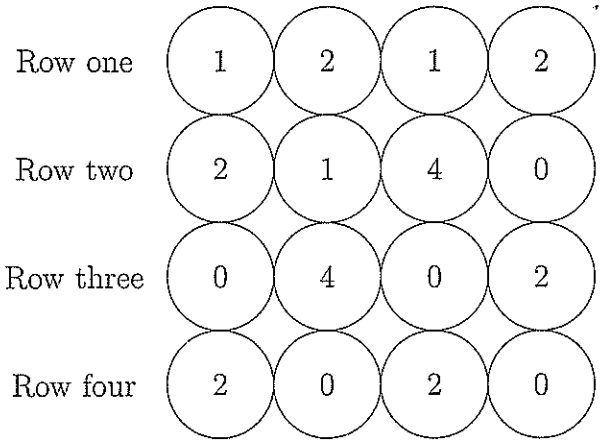
(A) 60 (B) 70 (C) 80 (D) 90 (E) 100

**14.** Beginning at the point $A$, Joel draws the spiral pattern of line segments below on a 1 cm grid. If he continues this pattern, how long, in centimetres, is the 97th segment?




(A) 46 (B) 47 (C) 48 (D) 49 (E) 50

**15.** Sixteen discs are arranged in four rows of four. The discs have a number on one side and are either red or green on the other. The number shows how many discs touching that disc have green on the other side.




Which of the following statements is true?

(A) All of the rows have the same number of green discs.
(B) Row one has more green discs than any other row.
(C) Row two has more green discs than any other row.
(D) Row three has fewer green discs than any other row.
(E) Row four has fewer green discs than any other row.

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**16.** While shopping this week I misread my shopping list and bought 5 loaves of bread and 2 bottles of milk. So I went back to the supermarket, got a full refund, and bought 2 loaves of bread and 5 bottles of milk. This cost me \$4.20 less than my first purchase. How do the prices of bread and milk compare?

(A) A loaf of bread costs \$1.40 more than a bottle of milk.
(B) A loaf of bread costs \$0.60 more than a bottle of milk.
(C) A loaf of bread costs \$0.42 more than a bottle of milk.
(D) A loaf of bread costs \$0.60 less than a bottle of milk.
(E) A loaf of bread costs \$1.40 less than a bottle of milk.

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**17.** Starting with the number 0 on my calculator, I do a calculation in five steps. At each step, I either add 1 or multiply by 2. What is the smallest number that cannot be the final result?

(A) 11 (B) 10 (C) 9 (D) 8 (E) 7

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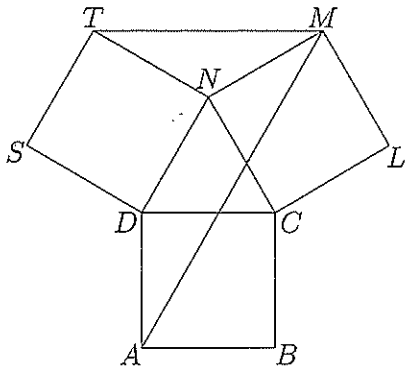
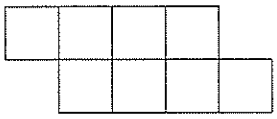
18. The three squares in the figure below are the same size. Find the value, in degrees, of $\angle AMT$.




(A) 45° (B) 50° (C) 55° (D) 60° (E) 75°

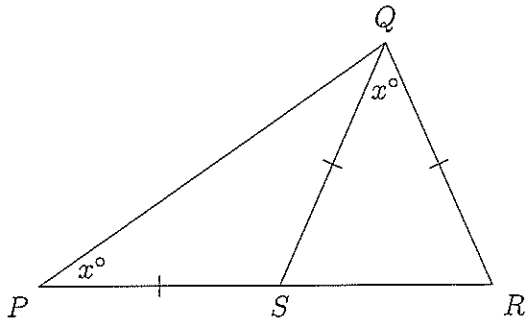
19. Eight $1 \times 1$ square tiles are laid as shown.



Two more $1 \times 1$ tiles are added, so that at least one side of each new tile is shared with a side of the original shape. Several different perimeter lengths are now possible. What is the sum of the shortest and longest possible perimeter of the modified shape?

(A) 28 (B) 30 (C) 32 (D) 34 (E) 36

20. In the triangle $PQR$, $S$ is a point on $PR$ such that $PQS$ and $SQR$ are both isosceles triangles (as shown). Angle $QPS$ is equal to angle $SQR$.

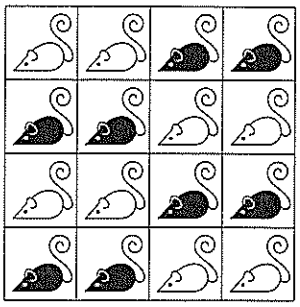



What is the value of $x$?

(A) 30 (B) 36 (C) 40 (D) 45 (E) 48

## Questions 21 to 25, 5 marks each

**21.** A biologist has a set of cages in a $4 \times 4$ array. He wants to put one mouse (black or white) into each cage in such a way that each mouse has at least one neighbour of each colour (neighbouring cages share a common wall).



The black mice are more expensive, so he wants to use as few of them as possible. What is the smallest number of black mice that he needs?

(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

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**22.** Two discs have different numbers on each side as shown.


The two sides of disc 1 The two sides of disc 2

The discs are flipped and they land on a table. The two numbers on the sides that are showing are added. If the possible sums that can be obtained in this way are 8, 9, 10 and 11, the sum $b + c + d$ is

(A) 8 (B) 18 (C) 20 (D) 27 (E) 30

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**23.** An *oddie* number is a 3-digit number with all three digits odd. The number of *oddie* numbers divisible by 3 is

(A) 20 (B) 26 (C) 29 (D) 41 (E) 42

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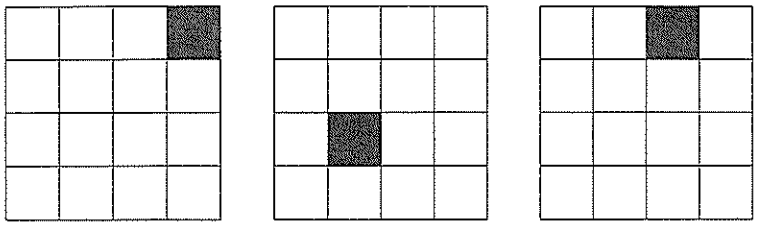
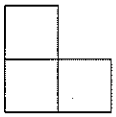
**24.** Consider the following $4 \times 4$ squares with a $1 \times 1$ square deleted (shown in black).




Consider tiling the squares P, Q and R using tiles like the one below.



Which of the following statements is true?

(A) Only P can be tiled this way.
(B) Only Q can be tiled this way.
(C) Only R can be tiled this way.
(D) Only P and Q can be tiled this way.
(E) All the shapes can be tiled this way.

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**25.** A number is formed by writing the numbers 1 to 30 in order as shown.

12345678910111213.....2930

Simeon removed 45 of these 51 digits leaving 6 in their original order to make the largest 6-digit number possible. What is the sum of the digits of this number?

(A) 33 (B) 38 (C) 41 (D) 43 (E) 51

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**For questions 26 to 30, shade the answer as an integer from 0 to 999 in the space provided on the answer sheet.**

**Question 26 is 6 marks, question 27 is 7 marks, question 28 is 8 marks, question 29 is 9 marks and question 30 is 10 marks.**

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**26.** Consider a sequence of letters where each letter is $A$ or $B$. We call the sequence *stable* if, when we tally the number of $A$s and the number of $B$s in the sequence, working from left to right, the difference is never greater than one. For example, the sequence $ABBABA$ is stable but the sequence $AABBAB$ is not, because after counting the first two letters, the difference is two. How many stable sequences with eighteen letters are there?

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**27.** Whenever Callum reads a date like 1/8/2013, he incorrectly interprets it as two divisions, with the second one evaluated before the first one:

$$1 \div (8 \div 2013) = 251\frac{5}{8}$$

For some dates, like this one, he does not get an integer, while for others, like 28/7/2013, he gets $28 \div (7 \div 2013) = 8052$, an integer. How many dates this year (day/month/year) give him an integer?

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**28.** What is the smallest positive integer that can be expressed as the sum of nine consecutive integers, the sum of ten consecutive integers and the sum of eleven consecutive integers?

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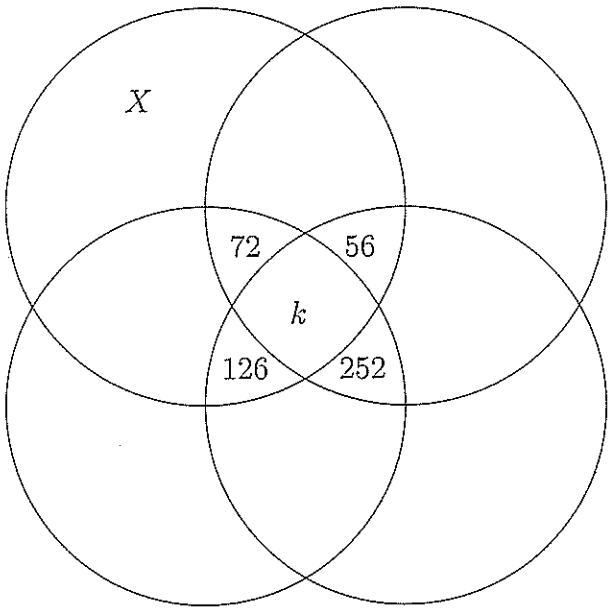
**29.** Each of the four circles below has a whole number value. $X$ is the value of the top-left circle. A number written on the figure indicates the product of the values of the circles it lies within. What is the value of $X + k$?

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**30.** Three different non-zero digits are used to form six different 3-digit numbers. The sum of five of them is 3231. What is the sixth number?

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