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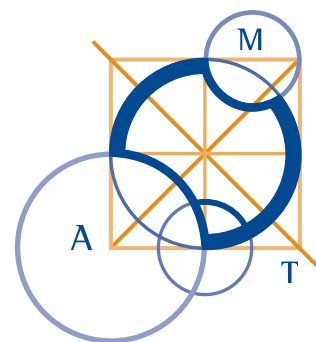
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AUSTRALIAN MATHEMATICS COMPETITION

AN ACTIVITY OF THE AUSTRALIAN MATHEMATICS TRUST

THURSDAY 2 AUGUST 2012

NAME _____



INTERMEDIATE DIVISION COMPETITION PAPER

AUSTRALIAN SCHOOL YEARS 9 AND 10
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 State or Region 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

The AMT reserves the right to re-examine students before deciding whether to grant official status to their score.

Intermediate Division

Questions 1 to 10, 3 marks each

1. The value of 8×3.3 is

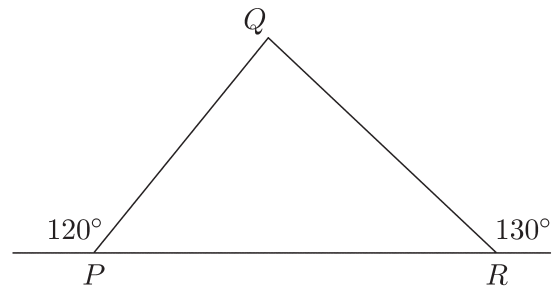
- (A) 24.24 (B) 24.4 (C) 25.4 (D) 26.24 (E) 26.4
-

2. Sally has \$20 of her pocket money left after 3 weeks, having spent just \$1 on a drink. How much pocket money does she get each week?

- (A) \$5 (B) \$7 (C) \$9 (D) \$20 (E) \$21
-

3. In the diagram, the size of $\angle PQR$ is

- (A) 40° (B) 50° (C) 60°
(D) 70° (E) 80°



4. Three-fifths of a number is 48. What is the number?

- (A) 54 (B) 60 (C) 64 (D) 80 (E) 84
-

5. By what number must 6 be divided to obtain $\frac{1}{3}$ as a result?

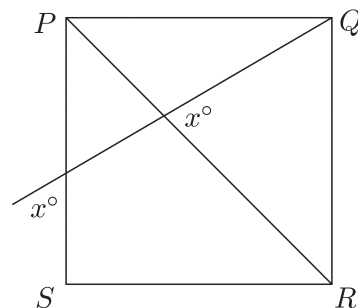
- (A) 18 (B) $\frac{1}{2}$ (C) $\frac{1}{18}$ (D) 2 (E) 9
-

6. The average of the five numbers x , 1, $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ is 1. The value of x is

- (A) $\frac{1}{5}$ (B) $\frac{2}{3}$ (C) $\frac{11}{5}$ (D) $\frac{25}{12}$ (E) $\frac{35}{12}$
-

7. In the diagram, $PQRS$ is a square. The value of x is

(A) 45 (B) 60 (C) 67.5
(D) 75 (E) 82.5



8. Five positive integers have a mean of 10, a median of 10 and only one mode, which is 12. What is the difference between the largest and smallest of these numbers?

(A) 3 (B) 5 (C) 6 (D) 7 (E) 8

9. If $750 \times 45 = p$, then 750×44 equals

(A) $p - 45$ (B) $p - 750$ (C) $p - 1$ (D) $44p$ (E) $750p$

10. I can ride my bike 3 times as fast as Ted can jog. Ted starts 40 minutes before me and then I chase him. How long does it take me to catch Ted?

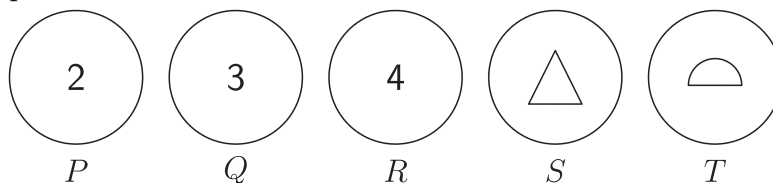
(A) 20 min (B) 30 min (C) 40 min (D) 50 min (E) 60 min

Questions 11 to 20, 4 marks each

11. If $p\%$ of q is k , then $q\%$ of p is

(A) $\frac{k}{100}$ (B) $\frac{pq}{200}$ (C) $\frac{pk}{100}$ (D) $\frac{qk}{100}$ (E) k

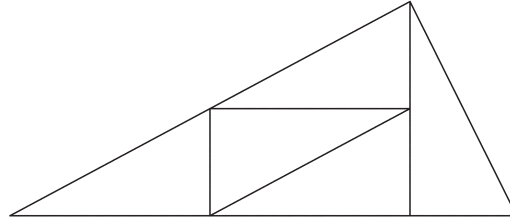
12. On one side of each of the five coins below there is a number and on the other side there is a shape.



Peter is told that if there is a triangle on one side of a coin then there is an even number on the other. Which of the following is the fewest coins that Peter can turn over from the five to check this?

(A) S (B) P and R (C) Q and S (D) P, Q, R and S (E) all coins

13. The architecture of Federation Square in Melbourne is based on frames as shown in which a large triangle is subdivided into 5 identical triangles, each similar to the large triangle.



If the shortest side of one of the smallest triangles is 1 m, how many metres of framing are required to construct the whole shape?

- (A) 20 (B) $8 + 4\sqrt{5}$ (C) $10 + 4\sqrt{5}$ (D) $12 + 4\sqrt{5}$ (E) $15 + 5\sqrt{5}$

14. If $a : b = 3 : 2$ and $a + 3b = 27$, what is the value of $a + b$?

- (A) 5 (B) 9 (C) 13 (D) 15 (E) 21

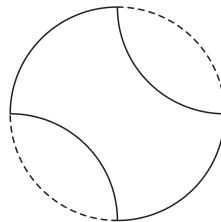
15. This sheriff's badge has ten equal sides, five 60° angles and five equal reflex angles.



The value of x is

- (A) 108 (B) 132 (C) 135 (D) 138 (E) 140

16. The shape shown is formed from four identical arcs, each a quarter of the circumference of a circle of radius 5 cm.



What is the area, in square centimetres, of the shape?

- (A) 50 (B) $\frac{25\pi}{2}$ (C) $25\pi - 25$ (D) $100 - \frac{25\pi}{2}$ (E) 25π

17. The number $2012 \times 2013 \times 2014 + 2013$ is the cube of
- (A) 2012 (B) 2013 (C) 2014 (D) 2112 (E) 2113

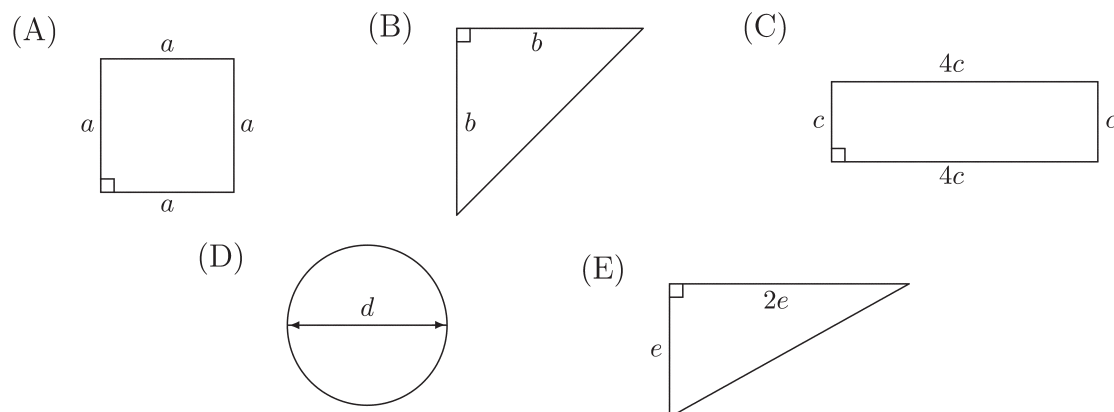
18. A *partition* of a positive integer is a way of writing the integer as a sum of at least two positive integers. For example, the partitions of 4 are:

$$3 + 1, 2 + 2, 2 + 1 + 1 \text{ and } 1 + 1 + 1 + 1.$$

How many partitions of 7 are there?

- (A) 11 (B) 12 (C) 13 (D) 14 (E) 15

19. These five shapes all have the same area. Which one has the largest perimeter?



20. Pippa made a litre of drink from apple juice and water in the ratio of 1 : 2. She found the taste too strong so she made a litre again in the ratio 1 : 3, but found this too weak. So she thought if she combined these two mixtures, it should be about right. What is the ratio of apple juice to water in this new mixture?

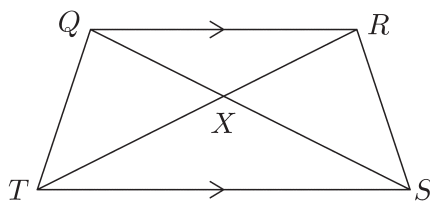
- (A) 2 : 5 (B) 2 : 7 (C) 5 : 12 (D) 7 : 17 (E) 7 : 24

Questions 21 to 25, 5 marks each

21. A courier company has motorbikes that can travel 300 km starting with a full tank. Two couriers, Anna and Brian, set off from the depot together to deliver a letter to Connor's house. The only refuelling is when they stop for Anna to transfer some fuel from her tank to Brian's tank. She then returns to the depot while Brian keeps going, delivers the letter and returns to the depot. What is the greatest distance that Connor's house could be from the depot?

- (A) 180 km (B) 200 km (C) 225 km (D) 250 km (E) 300 km

22. $QRST$ is a trapezium in which $QR \parallel TS$ and $QR : ST = 2 : 3$.



If the area of $\triangle XST$ is 18 square units, what is the area, in square units, of $\triangle RTS$?

- (A) 24 (B) 28 (C) 30 (D) 34 (E) 36

23. If $abc + ab + bc + ca + a + b + c = 104$, and a, b and c are positive integers, then $a^2 + b^2 + c^2$ is equal to

- (A) 49 (B) 51 (C) 54 (D) 56 (E) 60

24. A teacher has a class of twelve students. She thinks it would be a nice idea if they change desks every day, so she has painted arrows on the floor from desk to desk. Each desk has one arrow going to it and another going from it. Each morning, the students pick up their books and move to the desk indicated by the arrow. By choosing her arrows carefully, the teacher has arranged it so that the longest possible time will pass before all the students are back in their original desks at the same time. How many days is that?

- (A) 30 (B) 35 (C) 42 (D) 60 (E) 72

25. The number 33^{33} can be expressed as the sum of 33 consecutive odd numbers. The largest of these odd numbers is

- (A) $33^{32} + 32$ (B) $33^{31} + 32$ (C) $33^{32} - 32$ (D) $33^{31} - 32$ (E) 33^{32}

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.

26. Slim took a long road trip across Australia over a number of days (more than 1). When he arrived at his destination, he noted that he had travelled exactly 2012 kilometres. On the first day he travelled a whole number of kilometres and each subsequent day he travelled one more kilometre than the day before. What is the largest distance, in kilometres, that he could have travelled on the first day?

27. Five consecutive positive integers, p , q , r , s and t , each less than 10 000, produce a sum which is a perfect square, while the sum $q + r + s$ is a perfect cube. What is the value of $\sqrt{p + q + r + s + t}$?

28. A quadrilateral with sides 15, 15, 15 and 20 is drawn with each vertex on a circle. Around this circle a square is drawn, with each side tangent to the circle. What is the area, in square units, of this square?

29. In the grid shown, we need to fill in the squares with numbers so that the number in every square, except for the corner ones, is the average of its neighbours. The edge squares have three neighbours, the others four.

+1000				-1000
	x			
-1000				+1000

What is the value of the number in the square marked x ?

30. Terry has invented a new way to extend lists of numbers. To *Terryfy* a list such as $[1, 8]$ he creates two lists $[2, 9]$ and $[3, 10]$ where each term is one more than the corresponding term in the previous list, and then joins the three lists together to give $[1, 8, 2, 9, 3, 10]$. If he starts with a list containing one number $[0]$ and repeatedly *Terryfies* it he creates the list

$$[0, 1, 2, 1, 2, 3, 2, 3, 4, 1, 2, 3, 2, 3, 4, 3, 4, 5, 2, 3, 4, \dots].$$

What is the 2012th number in this *Terryfic* list?