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## Intermediate Division

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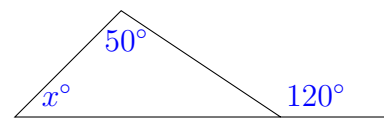
### Questions 1 to 10, 3 marks each

1.  $1 + 2 - 3 - 4 + 5 + 6 - 7 - 8 + 9 + 10 =$

- (A) 0                      (B) 1                      (C) 10                      (D) 11                      (E) 19
- 

2. In the diagram the value of  $x$  is

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



3. If  $p = 9$  and  $q = -3$  then  $p^2 - q^2$  is equal to

- (A) 64                      (B) 72                      (C) 84                      (D) 90                      (E) 96
- 

4. What value can be placed in the shape to make this statement true?

$$2014 \div \text{[shape]} = 100$$

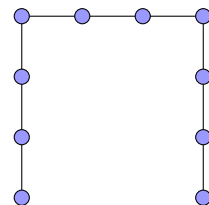
- (A) 0.02014                      (B) 0.2014                      (C) 2.014                      (D) 20.14                      (E) 201.4
- 

5. If  $\frac{5}{6}$  of a number is 30, what is  $\frac{3}{4}$  of the number?

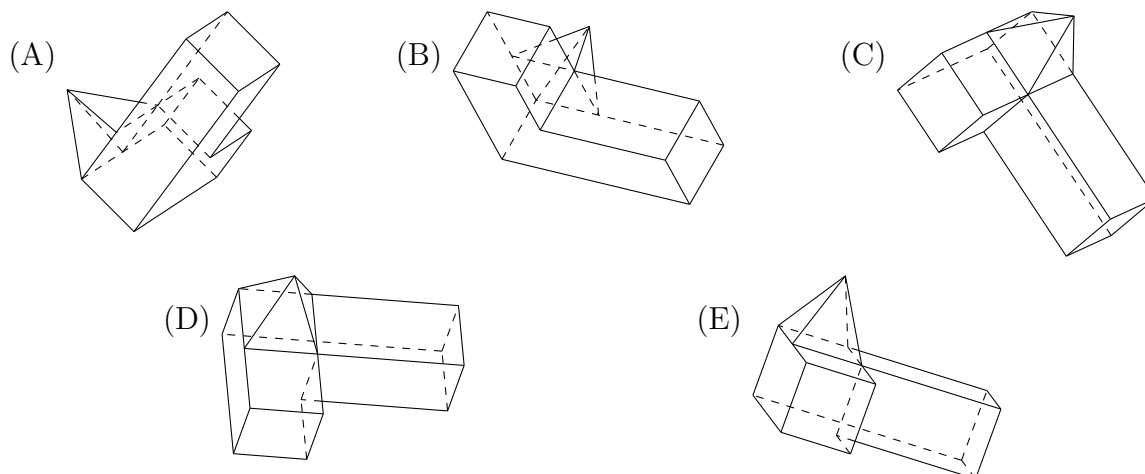
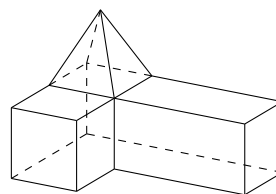
- (A) 22.5                      (B) 24                      (C) 25                      (D) 27                      (E) 40
- 

6. This diagram is called an *open square* of order 4, since the three sides are all the same length and each side has four posts spaced evenly along it. The total number of posts which would be evenly spaced along an open square of order 10 would be

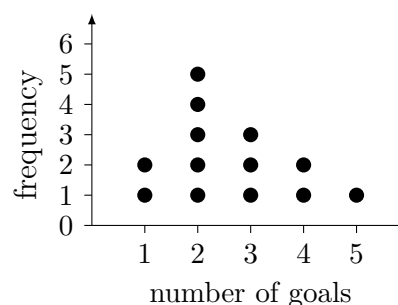
- (A) 26                      (B) 27                      (C) 28  
(D) 30                      (E) 32



7. Which of the objects below is not the same as the one on the right?



8. This graph shows the number of goals scored by Ranjit's soccer team in each of the first thirteen matches. After the fourteenth match, the median has increased but the mode has remained the same. Which of the following best describes the team's score in this last game?



- (A) Goals = 1    (B) Goals = 2    (C) Goals  $\geq 2$   
 (D) Goals < 3    (E) Goals  $\geq 3$
9. Forty-eight pavers, each  $1\text{ m} \times 1\text{ m}$  in size, are used to form a path 1 metre wide around a square garden. What is the area, in square metres, inside this path?
- (A) 100    (B) 110    (C) 121    (D) 132    (E) 144
10. Each May a farmer plants barley seed and then in October he harvests 12 times the weight of seed planted. From each harvest, he sells 50 tonnes and the rest he keeps as seed for the next year's crop. This year he has planted enough to harvest 120 tonnes. How many tonnes did he plant last year?
- (A) 5    (B) 10    (C) 20    (D) 30    (E) 60

**Questions 11 to 20, 4 marks each**

- 11.** If  $x$  is an integer and  $x < -1$ , which of the following expressions has the greatest value?

(A)  $\frac{1}{x}$                       (B)  $\frac{1}{x^2}$                       (C)  $x + 1$                       (D)  $-\frac{1}{x^2}$                       (E)  $-\frac{1}{x}$

- 12.** The 11 boys in Tom's cricket team have a contest to see how far they can throw a cricket ball. Their results, to the nearest metre, are

19, 26, 31, 31, 31, 33, 37, 42, 42, 48, 56

Which of the following lists the statistical measures for these results in the correct ascending order?

(A) mean, median, mode      (B) median, mean, mode      (C) mode, mean, median  
(D) median, mode, mean                      (E) mode, median, mean

- 13.** I have 800 mL of water in jug  $X$  and 800 mL of milk in jug  $Y$ . I pour 200 mL from jug  $X$  into jug  $Y$  and stir the mixture thoroughly. I then pour 200 mL of the resulting mixture from jug  $Y$  into jug  $X$ . What is the volume of milk that is now in jug  $X$ ?

(A) 150 mL                      (B) 160 mL                      (C) 175 mL                      (D) 180 mL                      (E) 200 mL

- 14.** The women's world record for running 400 metres was set in Canberra at 47.60 seconds. Which of the following is closest to the runner's average speed, in kilometres per hour?

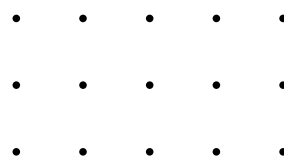
(A) 22                      (B) 24                      (C) 26                      (D) 28                      (E) 30

- 15.** Ten points  $Q, R, S, T, U, V, W, X, Y$  and  $Z$  are equally and consecutively spaced on a circle. What is the size, in degrees, of the angle  $\angle QTW$ ?

(A) 36                      (B) 54                      (C) 60                      (D) 72                      (E) 75

- 16.** A 3 by 5 grid of dots is set out as shown. How many straight line segments can be drawn that join two of these dots and pass through exactly one other dot?

(A) 14                      (B) 20                      (C) 22                      (D) 24                      (E) 30



17. A hotel has rooms that can accommodate up to two people. Couples can share a room, but otherwise men will share only with men and women only with women. How many rooms are needed to guarantee that any group of 100 people can be accommodated?

(A) 50                      (B) 51                      (C) 67                      (D) 98                      (E) 99

18. Two rectangular prisms are constructed. One measures  $4\text{ cm} \times 6\text{ cm} \times x\text{ cm}$  and the other measures  $3\text{ cm} \times 8\text{ cm} \times y\text{ cm}$  where both  $x$  and  $y$  are integers. If they have equal surface area, what is the smallest possible value of  $x + y$ ?

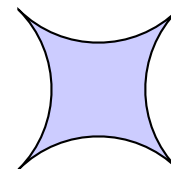
(A) 11                      (B) 21                      (C) 26                      (D) 42                      (E) 63

19. A four-digit number  $abcd$  is called *cool* if  $a$  is divisible by 4, the two-digit number  $ab$  is divisible by 5, the three-digit number  $abc$  is divisible by 6 and  $abcd$  is divisible by 7. How many cool numbers are there where 8 is not one of the digits?

(A) 3                      (B) 4                      (C) 5                      (D) 6                      (E) more than 6

20. 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 of the shape, in square centimetres?

(A)  $100 - 20\pi$                       (B) 100                      (C)  $25\pi + 25$   
(D)  $25\pi$                       (E)  $100 - 25\pi$



### Questions 21 to 25, 5 marks each

21. Standard six-sided dice have their dots arranged so that the opposite faces add up to 7. If 27 standard dice are arranged in a  $3 \times 3 \times 3$  cube on a solid table what is the maximum number of dots that can be seen from one position?

(A) 90                      (B) 94                      (C) 153                      (D) 154                      (E) 189

22. There are 10 integers in a set. Some are odd and some are even. For each possible pair selected from the set, the sum is written down. Of these 45 numbers, exactly 20 are even. How many of the numbers in the original set are even?

(A) 0                      (B) 3                      (C) 5                      (D) 8                      (E) 10

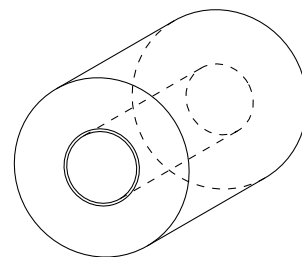
23. Starting with  $\frac{2}{3}$  of a tank of fuel, I set out to drive the 550 km from Scone to Canberra. At Morisset, 165 km from Scone, I have  $\frac{1}{2}$  of a tank remaining. If I continue with the same fuel consumption per kilometre and without refuelling, what happens?
- (A) I will arrive in Canberra with  $\frac{1}{9}$  of a tank to spare.  
 (B) I will arrive in Canberra with  $\frac{1}{20}$  of a tank to spare.  
 (C) I will run out of fuel precisely when I reach Canberra.  
 (D) I will run out of fuel 110 km from Canberra.  
 (E) I will run out of fuel 220 km from Canberra.

24. At a party, each person shakes hands with exactly three other people and no two people shake hands with each other more than once. If fewer than fifteen handshakes take place, what is the maximum number of people who can be at the party?
- (A) 6                      (B) 7                      (C) 8                      (D) 9                      (E) 10

25. Thanom has a roll of paper consisting of a very long sheet of thin paper tightly rolled around a cylindrical tube, forming the shape indicated in the diagram.

Initially, the diameter of the roll is 12 cm and the diameter of the tube is 4 cm. After Thanom uses half of the paper, the diameter of the remaining roll is closest to

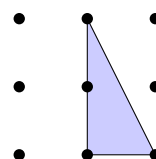
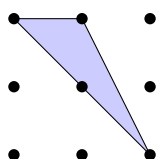
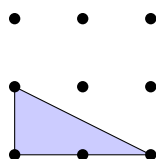
- (A) 6 cm                      (B) 8 cm                      (C) 8.5 cm  
 (D) 9 cm                      (E) 9.5 cm



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

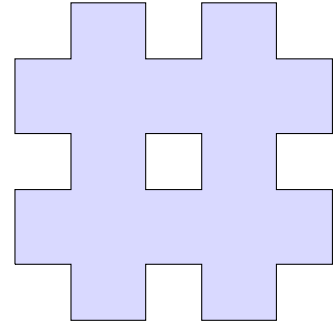
Question 26 is 6 marks, question 27 is 7 marks, question 28 is 8 marks, question 29 is 9 marks and question 30 is 10 marks.

26. In a  $3 \times 3$  grid of points, many triangles can be formed using 3 of the points as vertices. Three such triangles are shown below. Of all these possible triangles, how many have all three sides of different lengths?

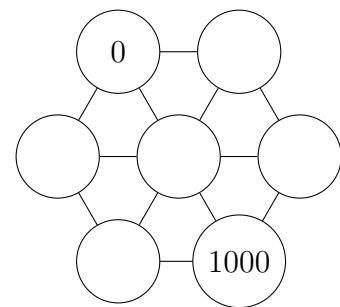


27. Small squares of side  $x$  cm have been removed from the corners, sides and centre of a square of side  $y$  cm to form the gasket shown.

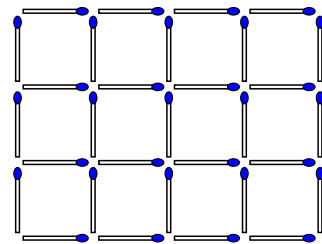
If  $x$  and  $y$  are prime numbers and the sum of the inside and outside perimeters of the gasket, in centimetres, is equal to the area of the gasket, in square centimetres, what is the smallest possible value of the area of the gasket?



28. In the diagram on the right, each circle has three or six neighbours. Each circle will contain a number, and each of the five missing numbers is the average of its neighbours. What is the largest of the five missing numbers?



29. As shown in the diagram, you can create a grid of squares 3 units high and 4 units wide using 31 matches. I would like to make a grid of squares  $a$  units high and  $b$  units wide, where  $a < b$  are positive integers. Determine the sum of the areas of all such rectangles that can be made, each using exactly 337 matches.



30. Consider the sequence  $a_1, a_2, a_3, a_4, \dots$  such that  $a_1 = 2$  and for every positive integer  $n$ ,

$$a_{n+1} = a_n + p_n, \quad \text{where } p_n \text{ is the largest prime factor of } a_n.$$

The first few terms of the sequence are 2, 4, 6, 9, 12, 15, 20. What is the largest value of  $n$  such that  $a_n$  is a four-digit number?

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