



JUNIOR CYCLE SOLUTIONS 2006

1. Which one of the following numbers is **not** equal to 2?

- (A) The number of wheels on a bicycle.
- (B) The number of shoes in a pair.
- (C) The number of teams that contested the 2006 All-Ireland Senior hurling final.
- (D) The number of sides in a triangle.
- (E) The number of hours between 11p.m. on October 19 and 1a.m. on October 20 (in the same year).

Solution:(D) - the number of sides in a triangle is three.

2. Which one of the following numbers is **not** equal to 6?

- (A) The number of faces of a cube.
- (B) The number of musicians in a string quartet.
- (C) The number of eggs in a half-dozen.
- (D) The combined number of legs in the horse/rider combination that won the 2006 Irish Grand National.
- (E) The combined number of wheels on one tricycle, one bicycle and one unicycle.

Solution:(B) The number of musicians in a quartet is four.

3. Which one of the following numbers is the largest?

- (A) 3^2 (B) 8 (C) 2×3 (D) $\frac{15}{2}$ (E) $\frac{20}{3}$

Solution:(A) : $3^2 = 9$, all the others are less than 9.

4. Andy, Benny and Charlie have 21 apples between them. Andy thinks to himself "If Charlie gave me two of his apples, we would all have the same number of apples". How many apples does Andy have?

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

Solution:(E) : If Charlie gave Andy two apples, then each of the three would have seven apples, since $21 = 3 \times 7$. So Andy must have $7 - 2 = 5$ apples at present.

5. Which of the following numbers is the largest?

- (A) $\frac{17}{20}$ (B) $\frac{9}{10}$ (C) $\frac{4}{5}$ (D) $\frac{13}{15}$ (E) $\frac{3}{4}$

Solution:(B) : If we write each fraction with 60 as the denominator, the list becomes

- (A) $\frac{51}{60}$ (B) $\frac{54}{60}$ (C) $\frac{48}{60}$ (D) $\frac{52}{60}$ (E) $\frac{45}{60}$

6. Which of the following numbers is equal to $10^7 - 999,999$?

- (A) 1 (B) 11 (C) 9,000,001 (D) 9,999,999 (E) 9,111,111

Solution:(C): $10^7 - 999999 = 10000000 - 999999 = 9,000,001$

7. A drawer contains 10 white socks, 10 black socks and 10 blue socks (and nothing else). The light is not working and Jerome is packing in the dark to go on an overnight trip. What is the minimum number of socks that he must pack if he wants to be certain that he will have a pair of the same colour?

- (A) 3 (B) 4 (C) 22 (D) 6 (E) 2

Solution:(B) : 4. If Jerome takes only three socks, he may have three of different colours. But there are only three different colours available. So if Jerome takes four socks they cannot all have different colours, so he can be sure of having two of the same colour.

8. In a building at the zoo there are zebras and ostriches. If these animals have a total of 26 legs and 18 eyes, how many ostriches are there?

- (A) 4 (B) 6 (C) 3 (D) 5 (E) 9

Solution:(D) : Let x and y respectively be the number of zebras and the number of ostriches. Each zebra has four legs and two eyes, and each ostrich has two legs and two eyes. So the total number of eyes is $2x + 2y$ and the total number of legs is $4x + 2y$. Thus

$$\begin{aligned}2x + 2y &= 18 \\4x + 2y &= 26\end{aligned}$$

Subtracting the first of these equations from the second gives $2x = 8$, so $x = 4$. Then $y = 5$, so there are five ostriches.

9. A certain street contains 100 houses. If the houses are to be numbered 1 to 100, how many times will the digit 9 appear?

- (A) 20 (B) 10 (C) 19 (D) 9 (E) 12

Solution:(A) : The digit 9 appears in the numbers

9, 19, 29, 39, 49, 59, 69, 79, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99.

The total number of appearances is 20 - there are 19 house numbers here, and the digit 9 appears twice in 99 and once in each other number.

10. A rabbit falls into a dry well, 29.9 metres deep. When she attempts to climb out, she finds that she can climb three metres every day. However she cannot climb continuously, and every day as she rests she slips back two metres. How many days does it take for the rabbit to get out of the well?

- (A) 27 days (B) 30 days (C) 10 days (D) 28 days (E) 29 days

Solution:(D) : At the end of day 27/beginning of day 28 the rabbit will be 27 metres from the bottom of the well, having never reached a height higher than 29 metres. During day 28 she will be able to climb the remaining 2.9 metres and get out of the well.

11. How many positive 2-digit whole numbers are odd? (Please note that the positive 2-digit whole numbers are those in the range 10–99 inclusive).

(A) 90 (B) 50 (C) 46 (D) 44 (E) 45

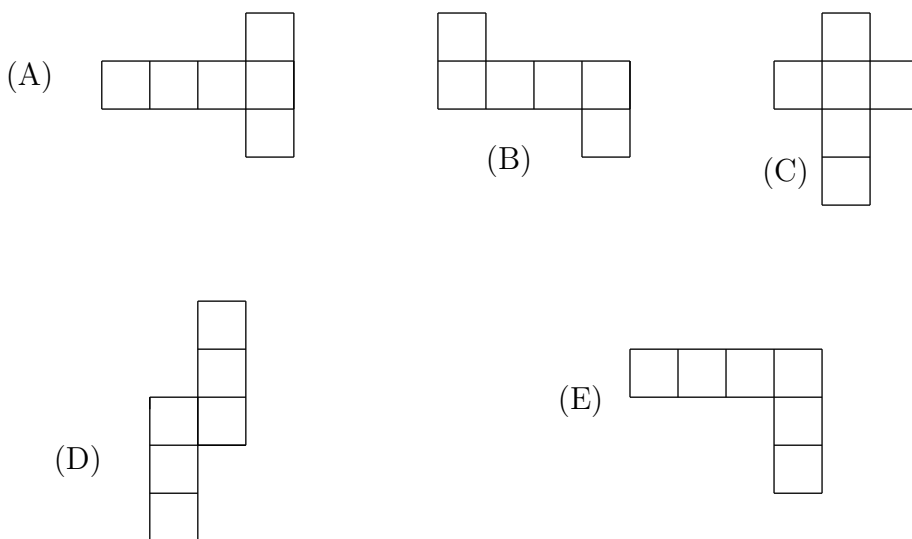
Solution:(E) : The total number of 2-digit whole numbers is 90, and these start with an even number (10) and end with an odd number (99). Since they alternate between even and odd there are 45 of each.

12. John gives half his money to Emma, who then gives half of that to Séamus, who then gives half of that to John. What fraction of his original amount does John now have?

(A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) $\frac{5}{8}$ (D) $\frac{3}{8}$ (E) $\frac{1}{8}$

Solution:(C) : The amount given by John to Emma is half of the total amount originally in John's possession. The amount given by Emma to Séamus is one quarter of the total, and the amount given by Séamus to John is one eighth of the total. So at the end of the exchanges John has $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$ of his original amount.

13. Which of the following diagrams *cannot* be cut out around its outline and folded to make a cube having the six squares in the diagram as faces?



Solution:(E) : Suppose that the diagram in (E) could be folded into a cube. Then the four squares forming a horizontal line in the diagram would have to be arranged in a band around the cube, leaving two opposite faces to be filled. But the two faces that are not in the horizontal line cannot be opposite in a cube since they have a common edge.

14. If $a + b = 10$ then what is $a^2 + b^2 + 2a + 2b + 2ab$?

(A) 25 (B) 100 (C) 120 (D) 200 (E) 101

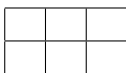
Solution:(C) : $a^2 + b^2 + 2a + 2b + 2ab = a^2 + 2ab + b^2 + 2(a + b) = (a + b)^2 + 2(a + b) = 10^2 + 2(10) = 120$.

15. If a length of 4 kms of fence can enclose a square plot of 100 hectares of land, how many hectares of land will 8 kms of fence enclose in a square?

(A) 400 (B) 200 (C) 250 (D) 150 (E) 300

Solution:(A) : The area enclosed by a square of side length 2km is 4 square kilometres, which is four times the area enclosed by a square of side length 1 km.

16. How many rectangles are visible in the figure below?



- (A) 1 (B) 7 (C) 18 (D) 12 (E) 6

Solution:(C) : There are six rectangles consisting of one small rectangle.

There are seven rectangles consisting of two small rectangles (three vertical and four horizontal).

There are two rectangles consisting of three small rectangles.

There are two rectangles consisting of four small rectangles.

There is one rectangle consisting of six small rectangles.

So the total number of rectangles is $6 + 7 + 2 + 2 + 1 = 18$.

17. An amoeba is placed in a jar and each minute it doubles its size by splitting its cells in two. Suppose that the jar will be completely filled in 10 minutes. How long (in minutes) would it take to fill the jar if instead of one amoeba there had been two amoebas in it to start?

- (A) 10 (B) 9 (C) 5 (D) 1 (E) 6

Solution:(B) : 9 minutes. To see why, think about the situation when one amoeba is placed in the jar. After one minute there are two amoebas, and from this point it takes a further 9 minutes for the jar to be filled.

18. In an art class, a student is given a white cube and told to paint two of its faces red and one face green. How many differently coloured cubes could the student produce?

- (A) 60 (B) 15 (C) 1 (D) 2 (E) 3

Solution:(E) : Suppose the student paints the two red faces first. If these two faces are opposite, then the finished product will look the same regardless of which of the remaining faces is painted green.

If the two red faces are not opposite to each other then they share an edge. In this case there are two ways to complete the cube. The student can paint a face opposite to one of the red faces green. Both possibilities for the choice of green face here produce the same finished cube.

Alternatively, the student can choose one of the two faces which is opposite to neither of the red faces (and adjacent to both) and paint this face green. Both of these choices will produce similarly coloured cubes.

So the number of differently coloured cubes that can be produced is three.

19. What is the remainder when 2^{100} is divided by 5?

- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4

Solution:(B) :

The remainder when 2^1 is divided by 5 is 2.

The remainder when 2^2 is divided by 5 is 4.

The remainder when 2^3 is divided by 5 is 3.

The remainder when 2^4 is divided by 5 is 1.

This cycle repeats as the powers of 2 increase (think about this!). If n is a multiple of 4, then the remainder on dividing 2^n by 5 is 1. So the remainder on dividing 2^{100} by 5 is 1.

20. Ann, Betty and Cathy are sisters. One of them always tells the truth, one of them always lies and one of them sometimes tells the truth and sometimes lies.
Betty says "Ann sometimes lies, but not always".
Cathy says "Ann always lies".
Betty says "Cathy sometimes lies, but not always".
Ann says "Cathy sometimes lies, but not always".

Which one of the following statements is **false**?

- (A) Betty lies, at least sometimes.
- (B) Cathy tells the truth, at least sometimes.
- (C) It is possible to determine from the given information which of the three always tells the truth.
- (D) Ann tells the truth, at least sometimes.
- (E) It is possible to determine from the given information which of the three always lies.

Solution:(D) : Betty cannot be telling the truth about both Ann and Cathy. So Betty does not always tell the truth.

Suppose now that Ann is the one who always tells the truth. This would mean that Ann is telling the truth about Cathy. So Cathy sometimes lies, but not always. But then the same is true of Betty since she is telling the truth about Cathy but lying about Ann.

So it must be that Cathy is the one who always tells the truth. Then she is telling the truth about Ann. So Ann always lies, and the statement in (D) is false.