SOUTH AFRICAN MATHEMATICS OLYMPIAD

Grade EIGHT First Round 2022

Solutions

1. **C** $5^2 - 5 \times 2^2 = 25 - 5 \times 4 = 25 - 20 = 5$

2. **B** One tenth and one fifth in decimal form are 0,1 and 0,2 respectively.
Of those given, the only fraction lying between 0,1 and 0,2 is 0,18.

3. **A** $\dfrac{20 \times 22}{2\times0 + 2\times2} = \dfrac{20 \times 22}{4} = 5 \times 22 = 110$

4. **E** If $\dfrac{\sqrt[3]{p}}{3} = 1$ then $\sqrt[3]{p} = 3$, thus $p = 27$.

5. **C** The largest possible 2-digit number is 97, while the smallest possible 2-digit number is 12. The greatest possible difference is thus $97 - 12 = 85$.

6. **A** Thabo eats 4 of the 12 smaller pieces, and $\frac{4}{12}$ simplifies to $\frac{1}{3}$.
Alternatively, since 4 of the smaller pieces is the same as 2 of the original slices, he eats $\frac{2}{6} = \frac{1}{3}$ of the pizza.

7. **C** Since the Grade 8s represent 20% of the total, the total number of pupils is $30 \times 5 = 150$.

8. **D** For Julia, 30 stickers, at 5 stickers a day, takes 6 days. Daniel, at 6 stickers a day, will thus have $6 \times 6 = 36$ stickers.

9. **A** Area of shaded region $= 30 \times 4 + 40 \times 2 - 4 \times 2 = 192\ u^2$.

10. **C** Since the perimeter of the shaded region is 24 units, the side length of the larger square must be $24 \div 4 = 6$ units. The larger square thus has area of 36 units^2.

11. **D** Each postcard requires 4 drawing pins. However, since there are 24 overlaps we will only need $25 \times 4 - 24 = 76$ drawing pins.
Alternatively, for 1, 2 and 3 postcards we need 4, 7 and 10 drawing pins respectively. In general, for n postcards we require $3n + 1$ drawing pins.
For 25 postcards we thus need $3 \times 25 + 1 = 76$ drawing pins.

12. **B** All multiples of 7 fall under G. An obvious multiple of 7 close to 800 is 777. Thus 777, 784, 791 and 798 are all under G. 799 is thus under A, and 800 is under B.

13. **A** The area of the smallest square is $5 \times 5 = 25$ square units. The sum of the areas of the four regions is $4 \times 25 = 100$. So the area of the largest square is 100. Hence, the side length of the largest square is 10.

14. **E** If we let the bases of the four triangles be b_1, b_2, b_3 and b_4, then the area of the shaded region is $A = \frac{1}{2} \times b_1 \times 4 + \frac{1}{2} \times b_2 \times 4 + \frac{1}{2} \times b_3 \times 4 + \frac{1}{2} \times b_4 \times 4$. This simplifies to $A = 2b_1 + 2b_2 + 2b_3 + 2b_4 = 2(b_1 + b_2 + b_3 + b_4) = 2 \times 8 = 16$.

15. **D** At 9:00 the angle between the hour hand and the minute hand is 90°.
At 9:10 the minute hand has moved $\frac{1}{6} \times 360° = 60°$ while the hour hand has moved $\frac{1}{6} \times 30° = 5°$. The obtuse angle between the two hands at 9:10 is thus $90° + 60° - 5° = 145°$.

16. **E** Since Thabo gets every 4th day off and there are 7 days in a week, the number of days until an 'off' day next occurs on a Monday will the lowest common multiple of 4 and 7, i.e. 28.

17. **E** 792 prime factorises to $2^3 \times 3^2 \times 11$. For the number to be a perfect square, each power needs to be an even number. Thus $n = 2 \times 11 = 22$.

18. **B** Let us call the five people A, B, C, D and E. Suppose E is not in any of the two teams. Then A could be paired with either B, C or D (i.e 3 possibilities). Once A is paired, the second team is automatically also paired (e.g. if A is paired with C then B and D would be the second team). Thus, there are 3 ways to form the teams if E is excluded. Likewise, there would be 3 ways to form the teams if any particular individual is excluded. Hence, the total number of ways to form the two teams is $5 \times 3 = 15$.

19. **B** If we let the distance travelled be x, then the time taken at the slower speed is $x \div 10$ while the time taken at the faster speed is $(x + 20) \div 14$. Since these two times are the same we can set up and solve the equation $\frac{x}{10} = \frac{x+20}{14}$ to give $x = 50$.
Alternatively, the difference between the two speeds is 4 km/h. This means the additional 20 km could be achieved at a speed of 4 km/h in the given time. The time for the journey is thus $20 \div 4 = 5$ hours, and the required distance is 10 km/h x 5 h = 50 km.

20. **D**