SOUTH AFRICAN MATHEMATICS OLYMPIAD
2012 Junior Grade 9 Round 1
Solutions

1. **B** $\frac{1}{2}+\frac{1}{3}=\frac{3}{6}+\frac{2}{6}=\frac{5}{6}$

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2. **A** $2x + 7° + x - 1° = 90°$, so $3x = 84°$ and $x = 28°$

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3. **E** Each fold doubles the thickness, and there are six more folds to be done. So the resulting thickness will be $2{,}5 \times 2^6 = 160$ mm

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4. **D** The number of rows of dots is the P number; the number of columns is one greater. So the number of dots in P30 is $30 \times 31 = 930$.

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5. **E** The two primes could be 5+31, 7+29, 13+23, 17+19, with corresponding products 155, 203, 299, 323.

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6. **E** 30 cm in 100 years is 300 mm in 5200 weeks and so $\frac{300}{5200}=\frac{3}{52}\approx\frac{6}{100}$ mm per week.

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7. **D** He takes $\frac{8}{3}$ minutes per lap, and will cycle for 240 minutes. That will cover $\frac{240}{8/3}=90$ laps.

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8. **B** Three extra minutes of speaking costs an extra R3. So 12 minutes talking costs R12 and therefore the subscription is 25 –12 = R 13. That means the total bill for 25 minutes talking will be 13 + 25 = R 38.

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9. **D** $3^* = 2.3 + 1 = 7$, and $7^* = 2.7 + 1 = 15$.

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10. **C** $O\hat{P}S = 180° - x$ (cointerior), and since this is the exterior angle of the isosceles triangle PQS, $P\hat{Q}S = \frac{1}{2}(180° - x) = 90° - \frac{x}{2}$. But $O\hat{Q}R = 90°$, so $R\hat{Q}S$ must be $\frac{x}{2}$

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11. **E** $1 = 1$; $1 + 3 = 4$; $1 + 3 + 5 = 9$;... so we see that after n terms the sum of the series is n^2. For this to be 400 we need $n = 20$.

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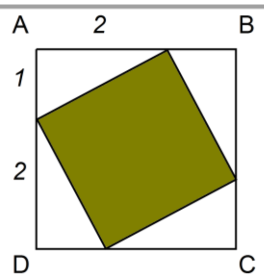
12. **A** Lengths must be as marked, so that each side of the smaller square is, by Pythagoras, $\sqrt{5}$. But then the area of the smaller square is 5 units^2 while the area of the larger square is 9 units^2, so the ratio is $\frac{5}{9}$



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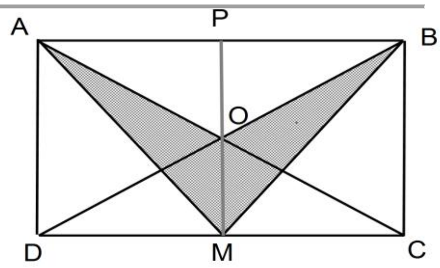
13. **E** If Anne's age now is x, then three years before she was half as old it was $\frac{x}{2}-3$. So we have $x=3\left(\frac{x}{2}-3\right)$, which gives $2x = 3(x-6)$ and then $x = 18$.

14. **B** The area of the whole circle is $4 \times 9\pi = 36\pi$, so the radius must be 6. The perimeter is made up of the curved arc plus two radii, so $\frac{1}{4}(2.\pi.6) + 2.6 = 3\pi + 12 = 3(\pi + 4)$

15. **C** We must have the last digit being odd, and also bigger than the first digit. If the last digit is 1 that is not possible, but if the last digit is 3 then the first can be 1 or 2, while the middle digit can be any one of the ten digits. Similarly if the last digit is 5, the first can be any of 1, 2, 3, 4 and the middle digit is not restricted. Continuing in this way we find the total number of possible three-digit numbers is $2\times10 + 4\times10 + 6\times10 + 8\times10 = 200$.

16. **B** M and N cannot both be odd because then (A) and (D) are both true. If M is odd and N is even then (A), (B) and (C) are true. If M is even and N is odd then (C) and (D) are true. Thus M and N must both be even and only (B) is true.

17. **B** Drawing the line MOP shows that Δ ADM = $\frac{1}{4}$ABCD, Δ BMC = $\frac{1}{4}$ABCD and of course Δ AOB = $\frac{1}{4}$ABCD. The shaded area is the remainder, and thus also $\frac{1}{4}$ABCD



18. **C** If X is her test percentage, then the overall score is $0{,}75 \times 82 + 0{,}25 \times X = 80$. This gives $0{,}25X = 80 - 0{,}75\times82 = 80 - 61{,}5 = 18{,}5$ and so her required score in the test is $4 \times 18{,}5 = 74\%$

19. **D** Each term leaves a remainder of 1 when divided by 8. So the total of the terms leaves the same remainder as the number of them, which is $\frac{1013+1}{2}=507$. That remainder is 3.

20. **A** If DP = x cm, then by symmetry PD' = x and CD' = 10. By Pythagoras in Δ CBD', BD' = 8, so AD' = 2. Now Pythagoras in Δ APD' gives $x^2 = (6-x)^2 + 2^2$, which means that $0 = 36 - 12x + 4$, so that $x = \frac{40}{12} = \frac{10}{3}$