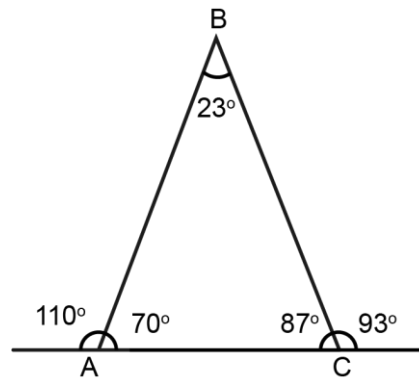


Mathematica Centrum

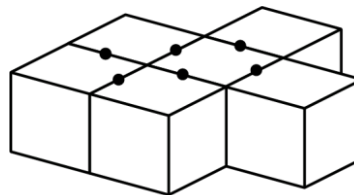
Together, let's shape the mathematicians of the future

NEWTON PREPARATORY TEST 2018 DETAILED SOLUTIONS

- The numbers 3 ($3 + 1 = 4$), 15 ($15 + 1 = 16$), and 48 ($1 + 48 = 49$) yield a perfect square when you add 1 to them.
- The largest possible sum, less than 10, of two consecutive prime numbers is $(3 + 5) 8$.
- If $\frac{3}{4}$ of a number is equal to 8, then $\frac{9}{4}$ of the same number is equal to $(8 \times 3) 24$.
- $n \div \frac{1}{6} = 18$ is equivalent to $n \times 6 = 18$.
The value of $n \times 2$ is $(3 \times 2) 6$.
- The value of angle B is 23° .
- $(50\% \text{ of } 50\%)\%$ is equal to $(\frac{1}{2} \times \frac{1}{2} = \frac{1}{4})$
 $\frac{1}{4} \%$ or $\frac{1}{400}$.

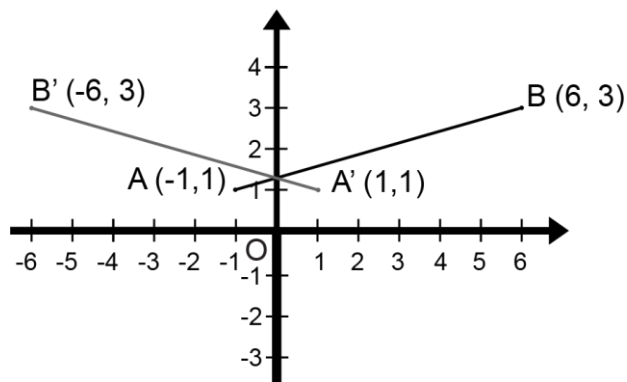


- Starting with -9, all integers are written in increasing order: -9, -8, -7, -6, -5, -4, -3, -2, The 20th digit that will be written is a (-9, -8, -7, ...-1, 0, 1, 2, 3, ... 9, 10) 1.
- When the bottom layer of blocks are glued together, 12 faces will have glue on them. Another six faces will have glue on them when the two top blocks are put into place. In all, 18 faces of the eight blocks have glue on them.
- The price after the 40% increase will be $(\$100 + \$40) \$140$. The price after the 30% decrease will be $(\$150 - \$45) \$105$. When bought together, the price of the two items will be $(\$140 + \$105) \$245$. The price of the two items decreases by $(\$250 - \$245 = \$5$ and $(\$5 / \$250) \times 100 = 2/100) 2\%$
- If $P + Q = 12$, the greatest possible value of the expression $P \times Q$ is 36.



P	Q	P X Q
0	12	0
1	11	11
2	10	20
3	9	27
4	8	32
5	7	35
6	6	36

11. Line segment AB is reflected in the y-axis. The coordinates of the images of points A and B, after the reflection, are respectively, (1, 1) and (-6, 3).

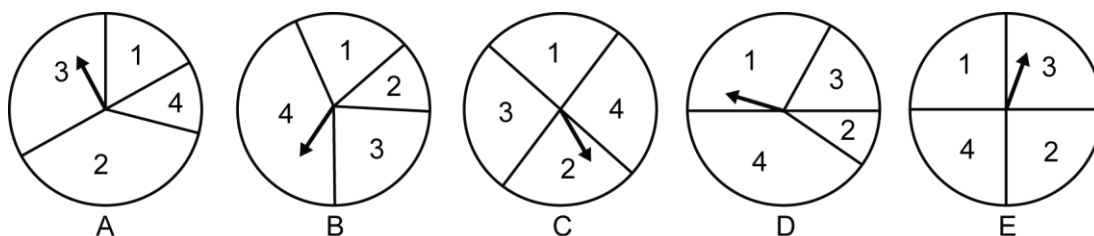


12. The result of the number of faces of a cube (6) plus the number of edges of a cube (12) plus the number of vertices of a cube (8) minus the number of angles of a cube (24) is equal to 2.

13. The LCM (3, 4, 5) = 60.

14. $1 \text{ cm}^2 = 100 \text{ mm}^2$ and $20 \text{ cm}^2 = 20 \times 100 \text{ mm}^2 = 2\,000 \text{ mm}^2$

15. The probability of getting a 2 or a 4 with spinner B is more than $1/2$.



16. There are 16 (1×1 squares), 9 (2×2 squares), 4 (3×3 squares), and 1 (4×4 square) in a 4×4 square (fig.1). In all, there are $(16 + 9 + 4 + 1)$ 30 squares. In other words, there are $(4^2 + 3^2 + 2^2 + 1^2)$ distinct squares in a 4×4 square. In a 3×3 square, you can count a total of $(3^2 + 2^2 + 1^2)$ 13 distinct squares. Verify this assertion by counting the number of squares in the 3×3 square shown in the diagram (fig.2).

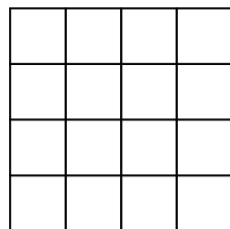


fig.1

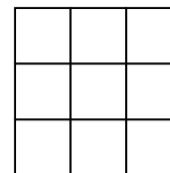


fig.2

17. The area of the small triangle can be written as $(b \times h)/2$. The area of the large triangle can be written as $(2b \times 2h)/2$. The area of the small triangle is $((b \times h)/2) \div 2/(2b \times 2h)$ the area of the large triangle. The area of the small triangle is $1/4$ of the area of the large triangle.

18. The sum of angle A + angle B + angle C = 180° .
 Angle C + 20° + angle C + 10° + angle C = 180° .
 We find that angle C = 50° and angle B = 60° .
 The sum of angle B + angle C = $50^\circ + 60^\circ = 110^\circ$.

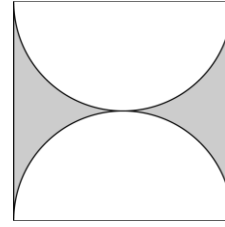
$\angle A = \angle C + 20^\circ$
$\angle B = \angle C + 10^\circ$
$\angle C = \angle C$

19. The only 3 prime numbers that add up to 19 are 3, 5, and 11. One of these prime numbers must be 11.

20. There are 3 possibilities for the hundreds digit (2, 3, or 4), 3 for the tens digit, and 3 for the units digit. In all, there are 27 ($3 \times 3 \times 3$) 3-digit natural numbers that can be formed using the digits 2, 3, and 4. When the 27 digits that appear in the units column are added, we get $(9 \times 2 + 9 \times 3 + 9 \times 4)$ 81. The 27 digits in the tens column add up to (81×10) 810 and the sum of the digits in the hundreds column is (81×100) 8 100. The sum of all the 27 numbers is $(8\,100 + 810 + 81)$ 8 991.

21. The value of n in the equation below is (10^2) 100.

$$\sqrt[2]{\frac{2}{1} \times \frac{3}{2} \times \frac{4}{3} \times \frac{5}{4} \times \dots \times \frac{n}{m}} = 10$$



The value of $m \times n$ is (99×100) 9 900.

22. The area of the square is $(8 \text{ cm} \times 8 \text{ cm})$ 64 cm^2 .
 The area of the two half-circles is $(\pi 4^2)$ $16\pi \text{ cm}^2$.
 The area of the shaded surface is $64 - 16\pi \text{ cm}^2$.

23. We find the coordinates of point A by solving the system $y = -3x + 15$ and $y = 2x$. Solving the equation $-3x + 15 = 2x$, we find $x = 3$ and $y = 6$. The coordinates of point A are $(3, 6)$.

