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1) **C** Evaluate according to the order of operations: $-2^3 - (-3)^3 = -8 - (-27)$
$= 19$

2) **A** The mixed fraction $2\frac{1}{5}$ is equivalent to 2.2 and the mixed fraction $2\frac{1}{10}$ is equivalent to 2.1. From least to greatest, the numbers are: 2.02, 2.1, 2.2, 2.202, 2.22. The number in the middle is 2.2.

3) **C** The average of a set of numbers is equal to the sum of the numbers divided by the number of numbers. If the average of five numbers is 6, then the sum of the numbers is $5 \times 6 = 30$. If two of the numbers are 7 and 9, the sum of the other three numbers is $30 - 7 - 9 = 14$.

4) **C** Using the law of fractional exponents, convert the expression $64^{\frac{2}{3}}$ to $\left(\sqrt[3]{64}\right)^2$. The cubed root of 64 is 4 because $4 \times 4 \times 4 = 64$. The square of 4 is $4 \times 4 = 16$.

5) **B** A prime number is a number that has exactly two factors: 1 and itself. The smallest prime number is 2. A composite number is a number that has three or more factors. The smallest composite number is 4. When the smallest prime number is subtracted from the smallest composite number, the result is $4 - 2 = 2$.

6) **A** To find 8% of a number, the number is multiplied by 8 and then divided by 100. To find the original number when 8% of a number is given, perform the opposite operations. The original number is $6 \times 100 \div 8 = 75$.

7) **A** The repeating sequence, ABCDEDCBA, has nine letters. The sequence repeats $2026 \div 9 = 225$ times entirely, leaving a remainder of 1. Therefore, the 2026th letter is the first letter in the sequence: A.

8) **B** The prime factorization of 210 is $2 \times 3 \times 5 \times 7$. The prime factorization of 63 is $3^2 \times 7$. The greatest common factor of 210 and 63 is $3 \times 7 = 21$.

9) **B** Review the given options to find one that is true.

A) False. The mode is 12 because it appears more frequently than any other number.

B) True. The mean is $(12 + 6 + 14 + 12 + 16) \div 5 = 12$

C) False. When the numbers are arranged in ascending order: 6, 12, 12, 14, 16, the middle number, or median, is 12.

D) False. The range of the data set is $16 - 6 = 10$.

10) **C** Estimate the cubed root of 990 Nine cubed is 729 and 10^3 is 1000. One of the consecutive numbers is likely to be 9. When 9 is multiplied by the next two consecutive integers, the result is $9 \times 10 \times 11 = 990$. The sum of the three consecutive integers is $9 + 10 + 11 = 30$.

11) **D** A cube of side length x has a volume of $x \times x \times x = x^3$. A cubic box of side length $3x$ has a volume of $3x \times 3x \times 3x = 27x^3$. Therefore, $27x^3 \div x^3 = 27$ cubes of side length x will fit in a cubic box of side length $3x$.

12) **A** Evaluate according to the order of operations:

$$\frac{7}{27} + \left(\frac{1}{3}\right)^2 - \frac{4}{9} + \frac{2}{9} \cdot \frac{3}{2} = \frac{7}{27} + \frac{1}{9} - \frac{4}{9} + \frac{1}{3}$$
$$= \frac{7}{27} + \frac{3}{27} - \frac{12}{27} + \frac{9}{27}$$
$$= \frac{7}{27}$$

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13) **B** Substitute into $x = 5$, $y = 7$, *and* $z = -4$ into $y^3 - x^3 + xyz$ and evaluate.

$7^3 - 5^3 + 5 \times 7 \times (-4) = 343 - 125 - 140$

$= 78$

14) **D** Step 1: Convert 27 into a power of 3 and simplify.

$3^{7x-9} = 27^4$

$3^{7x-9} = (3^3)^4$

$3^{7x-9} = 3^{12}$

Step 2: Set the exponents equal to each other and solve for x.

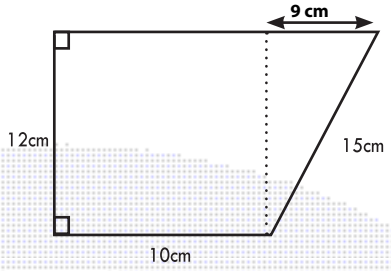
$7x - 9 = 12$

$7x = 21$

$x = 3$

15) **A** The mean of the prime numbers between 50 and 70 is $(53 + 59 + 61 + 67) \div 4 = 60$. The greatest prime number less than 60 is 59.

16) **B** The shape in the figure is a trapezoid. The formula for the area of a trapezoid is $A = (\text{base}_1 + \text{base}_2) \div 2 \times \text{height}$. The length of base_1 is equal to the length of base_2 plus an additional unknown length. This unknown length can be found by recognizing that the triangle shown is similar to the primitive Pythagorean 3 - 4 - 5 triangle, where each side length is multiplied by 3 to produce a 9 - 12 - 15 triangle. Therefore, the length of base_1 is $10 + 9 = 19$. The area of the trapezoid is $(19 + 10) \div 2 \times 12 = 174$ cm^2.

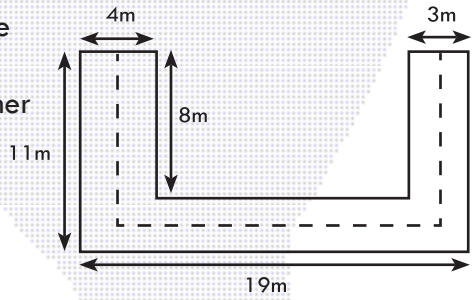


17) **C** All numbers who digits sum to 13 between 500 and 600 must begin with the digit 5 in the hundreds column. The remaining two numbers can be 0 and 8, or 1 and 7, or 2 and 6, or 3 and 5, or 4 and 4. The resulting numbers are: 508, 580, 517, 571, 526, 562, 535, 553, and 544 respectively. There are nine numbers in total.

18) **B** The only way that the sum of the rolls of three fair dice would total to 17 is if two 6's and one 5 are rolled in any order. One favourable outcome is 5, 6, 6. Another favourable outcome is 6, 5, 6. The third and final favourable outcome is 6, 6, 5. The total number of outcomes when rolling three fair dice is $6^3 = 216$. The probability of rolling a sum of 17 is $\frac{3}{216}$ which reduces to $\frac{1}{72}$.

19) **C** Assign two legs to each of the 44 heads for a total of $44 \times 2 = 88$ legs. Since there are 142 legs at the peak of the party, $142 - 88 = 54$ legs still need to be assigned and must be assigned to cows because all human heads have already received two legs. Therefore, there are $54 \div 2 = 27$ pairs of legs that are assigned to cows. This means that there are 27 cows and $44 - 27 = 17$ humans at the peak of the party and there were $27 - 17 = 10$ more cows than humans.

20) **A** The length of the vertical portion of the dotted line is 11 take away half the difference between 11 and 8. Therefore, the vertical dotted line is $11 - 1.5 = 9.5$ m. The length of the other vertical portion of the dotted line would also be 9.5 m. The length of the horizontal dotted line is 19 take away half of 4 and half of 3. Therefore, the horizontal dotted line is $19 - 2 - 1.5 = 15.5$ m. The total length of the dotted line is $9.5 + 15.5 + 9.5 = 34.5$ m.



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21) **C** The perimeter of a triangle is the sum of all the lengths of its sides. Set up an equation and solve for x.

$$7 + (x + 4) + (2x + 1) = 36$$
$$7 + 3x + 5 = 36$$
$$3x + 12 = 24$$
$$3x = 24$$
$$x = 8$$

The length of the longest side is $2x + 1$. Substitute $x = 8$ into $2x + 1$. The length of the longest side is $2 \times 8 + 1 = 17$ cm.

22) **D** The expression $6^{35} \cdot 8^{35}$ is equal to 48^{35} because when two powers with the same exponent are mutliplied, the bases can be multiplied and the exponent remains the same. Options A) and C) cannot be correct. To determine whether Option B) or D) is correct, rearrange the original expression into an expression with bases 2 and 12.

$$6^{35} \cdot 8^{35} = 6^{35} \cdot (2^3)^{35}$$
$$= 6^{35} \cdot 2^{105}$$
$$= 6^{35} \cdot 2^{35} \cdot 2^{70}$$
$$= 12^{35} \cdot 2^{70}$$

23) **C** The inequality $1 < x^2 \leq 25$ means that the square of x must be larger than 1 and smaller than or equal to 25. The positive values of x that would satisfy the inequality are 2, 3, 4, and 5 because $2^2 = 4$, $3^2 = 9$, $4^2 = 16$, and $5^2 = 25$ are all larger than 1 and smaller than or equal to 25. The negative values of x that would satisfy the inequality are -2, -3, -4, and -5 because $(-2)^2 = 4$, $(-3)^2 = 9$, $(-4)^2 = 16$, and $(-5)^2 = 25$ are all larger than 1 and smaller than or equal to 25. Therefore, there are 8 integers that satisfy the inequality.

24) **B** Choose a value for n. For example, let $n = 3$. The first 3 even integers are 2, 4, and 6. The first 3 odd integers are 1, 3, and 5. The difference between the sum of the first 3 even integers and the first 3 odd integers is $(2 + 4 + 6) - (1 + 3 + 5) = 3$. The result is the same as the value of n.

25) **C** According to the Triangle Inequality Theorem, the sum of the lengths of any two sides of a triangle must be greater than the length of the third side. Therefore, the triangle cannot be a 9 – 9 – 20 isosceles triangle because $9 + 9 < 20$. The triangle must be a 9 – 20 – 20 isosceles triangle because the sum of the lengths of any of its two sides is greater than the third side: $9 + 20 > 20$ and $20 + 20 > 9$. The perimeter of the triangle is $9 + 20 + 20 = 49$ cm.

26) **A** If yesterday was Tuesday, then today is Wednesday, and tomorrow is Thursday. There are seven days in one week. There are $286 \div 7 = 40$ weeks in 286 days with 6 days remaining. Therefore, 286 days after Thursday, the week would cycle 40 times back to a Thursday, plus an additional 6 days. Six days after Thursday is Wednesday.

27) **B** If a rectangle's length is increased by 40%, its length is multiplied by 1.4. If a rectangle's width is decreased by 40%, its width is multiplied by 0.6. The area of a rectangle is the product of the length and the width. The overall change in the area of the rectangle is $1.4 \times 0.6 = 0.84$. Therefore, the area changes by a multiplication factor of 0.84. This is the same as a 16% decrease in the area of the rectangle.

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28) **A** The formula for the circumference of a circle is $C = 2\pi r$ and the formula for the area of a circle is $A = \pi r^2$, where r is equal to the radius. Set the circumference to equal the area divided by 4 and solve for r.

$2\pi r = \pi r^2 \div 4$
$2r = r^2 \div 4$
$8r = r^2$
$r = 8$

29) **C** A 200% increase means that the original amount is mutliplied by 3. Out of 32 questions, Jimmy got 3 equal parts correct and 1 part incorrect, for a total of four equal parts. As a percentage, this means that Jimmy got three-quarters of 100%, which is 75%.

30) **A** Any three of the eight points can be connected to draw a triangle, unless all three points are collinear. The number of triangles that can be drawn from eight points, assuming none of the points are collinear is ${}_8C_3 = 8! \div (5! \times 3!) = 56$ because we are choosing three out of eight options. Then, subtract the triangles that cannot be drawn because of dots that are collinear. There are two rows of four dots each. Therefore, in each row, there are ${}_4C_3 = 4$ triangles that cannot be drawn. The total number of triangles that can be drawn is $56 - (4 \times 2) = 48$.

31) **D** The sum of the integers from 1 to 80 inclusive can be found using the formula $n(n + 1) \div 2$ where n is equal to the last integer. The sum of the integers from 1 to 80 is $80\,(80 + 1) \div 2$. The sum of all odd integers from 1 to 35 inclusive can be found using the formula $\frac{(n+1)^2}{2^2}$. The sum of all odd integers from 1 to 35 is $\frac{(35+1)^2}{4} = (35 + 1)^2 \div 4$

$$\frac{1+2+3+\cdots+79+80}{1+3+5+\cdots+33+35} = \frac{80\,(80+1) \div 2}{36^2 \div 4}$$
$$= \frac{3240}{324}$$
$$= 10$$

32) **C** The largest hexagon of Figure 5 would have 6 points as vertices and $4 \times 6 = 24$ additional points on its border, for a total of $6 + 24 = 30$ points. The largest nested hexagon in Figure 5 would have 3 points as vertices and $3 \times 4 = 12$ additional points on its border, for a total of $3 + 12 = 15$ points. The next three nested hexagons use 28 points, as indicated in the question. However, seven of those 28 points have already been counted in the largest hexagon. Therefore, the number of points needed to create Figure 5 is $30 + 15 + 28 - 7 = 66$

33) **B** The minute hand of a clock rotates 360° in an hour which is a full circle. Thus, the minute hand of a clock travels $360° \div 60 = 6°$ per minute. In 40 minutes, the minute hand moves $40 \times 6° = 240°$ counterclockwise. The hour hand of a clock travels $360° \div 12 = 30°$ in an hour or $30° \div 60 = 0.5°$ per minute. In 40 minutes, the hour hand traveled $40 \times 0.5° = 20°$. As the two hands were moving in opposite directions, the larger angle between them is $240 + 20 = 260°$. Therefore, the smaller angle between the minute hand and the hour hand is $360 - 260 = 100°$.

34) **A** The volume of the rectangular tank is $60 \times 60 \times 10 = 36000\ cm^3$. At a capacity of three-quarters, the volume of the tank is $36000 \times 0.75 = 27000\ cm^3$. The formula for the volume of a cylinder is $V = \pi r^2 h$. Using a height of 30 cm, and a volume of $27000\ cm^3$, solve for the radius.

$27000 = \pi r^2 \times 30$
$\frac{900}{\pi} = r^2$ The radius is the square root of $\frac{900}{\pi}$ which is $\frac{30}{\sqrt{\pi}}$ cm.

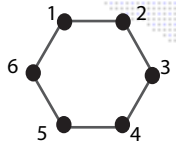
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35) **C** Check whether the triangle is a right triangle using the Pythagorean Theorem: $c^2 = a^2 + b^2$. Since $6.5^2 = 3.3^2 + 5.6^2$, the triangle is indeed a right triangle. Whenever a triangle that is inscribed inside a circle is a right triangle, the length of its hypotenuse (longest side) is the diameter of the circle because it passes through the origin of the circle. Therefore, the diameter of the circle is 6.5 cm and its radius is $6.5 \div 2 = 3.25$ cm.

36) **D** In one day, Painter A can complete $\frac{1}{4}$ of a mural, Painter B can complete $\frac{1}{6}$ of a mural, and Painter C can complete $\frac{1}{12}$ of a mural. On the first day, the three painters completed $\frac{1}{4} + \frac{1}{6} + \frac{1}{12} = \frac{1}{2}$ of the mural, working together. On the second day, Painter C stops working, and the combined rate of Painters A and B is $\frac{1}{4} + \frac{1}{6} = \frac{5}{12}$. If $\frac{1}{2}$ of the mural is left to complete, then the number of days it will take to complete at a combined rate of $\frac{5}{12}$ is $\frac{1}{2} \div \frac{5}{12} = \frac{6}{5}$. The total number of days required to complete the mural is $1 + \frac{6}{5} = \frac{11}{5}$.

37) **D** A triangle can be formed by drawing lines between any three vertices of a regular hexagon. This means that ${}_6C_3 = 6! \div (3! \times 3!) = 20$ different triangles can be formed from any three vertices of a regular hexagon. The only way that an equilateral triangle can be formed, is if the three vertices are one vertex away from each other. Only two equaliteral triangles can be formed. One using vertices 1, 3, and 5, and the other using vertices 2, 4, and 6. Therefore, the probability that three vertices chosen at random will form an equilateral triangle is $\frac{2}{20}$ which reduces to $\frac{1}{10}$.



38) **C** The burn rate of the first candle is $\frac{1}{4}$ and the burn rate of the second candle is $\frac{1}{8}$. Assuming an initial height of 8 units, the height of the first candle after t hours of burning can be represented by the formula $8 - 8 \times \frac{1}{4} \times t = 8 - 2t$. Similarly, the height of the second candle after t hours of burning can be represented by the formula $8 - 8 \times \frac{1}{8} \times t = 8 - t$. We are looking for the value of t when the height of the first candle is twice the height of the second candle. Set up an equation and solve for t.

$2(8 - 2t) = 8 - t$

$16 - 4t = 8 - t$

$t = \frac{8}{3}$

The value of t is $2\frac{2}{3}$ hours, or 2 hours and 40 minutes.

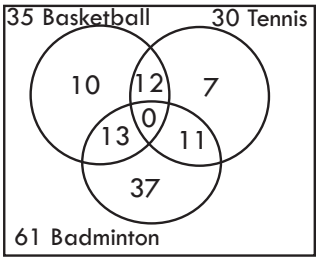
39) **B** The highest mark is the sum of all the marks, less the sum of the lowest four marks: $87 \times 5 - 83.75 \times 4 = 100$. The lowest mark is the sum of all the marks, less the sum of the highest four marks: $87 \times 5 - 91.25 \times 4 = 70$. The sum of the lowest and the highest mark is $100 + 70 = 170$.

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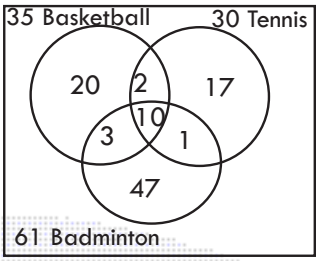
40) **D**

Draw a Venn Diagram, and suppose that zero members play all three sports. The number of members who play only basketball would be $35 - 12 - 23 = 10$. The number of members who play only tennis would be $30 - 12 - 11 = 7$. The number of members who play only badminton would be $61 - 13 - 11 = 37$. Adding all the regions in the Venn Diagram gives a total of $10 + 12 + 13 + 37 + 11 + 7 = 90$. However, the questions tells us that there are 100 members. Therefore, there must be $100 - 90 = 10$ members that play all three sports. Redraw the Venn Diagram, with the value of 10 in the middle where all three circles overlap. Now, the number of members who play basketball and tennis is $12 - 10 = 2$. The number of members who play basketball and badminton is $13 - 10 = 3$. The number of members who play badminton and tennis is $11 - 10 = 1$. The number of members that play only basketball is $35 - 2 - 3 - 10 = 20$. The number of members that play only badminton is $61 - 3 - 1 - 10 = 47$. The number of members that play only tennis is $30 - 2 - 1 - 10 = 17$. The total number of members that play exactly one sport is $20 + 47 + 17 = 84$.

Total: 110



Total: 100



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