

## AQA (GCSE Notes)

### Chapter 1: Number

**Q1.** Arrange the following numbers in ascending order:  $-3.7$ ,  $2\frac{3}{4}$ ,  $-2\frac{1}{2}$ ,  $3.6$ ,  $0$ .

**Answer:**  $-3.7$ ,  $-2\frac{1}{2}$ ,  $0$ ,  $2\frac{3}{4}$ ,  $3.6$

**Explanation:** Negative numbers are less than zero, and among negatives, the one with greater absolute value is smaller. Positive numbers follow accordingly.

**Q2.** Write the numbers  $\frac{7}{8}$ ,  $0.86$ , and  $\frac{7}{10}$  in descending order.

**Answer:**  $0.86$ ,  $\frac{7}{8}$ ,  $\frac{7}{10}$

**Explanation:**  $\frac{7}{8} \approx 0.875$  and  $\frac{7}{10} = 0.7$ . Hence,  $0.86 < 0.875 < 0.7$  is false. Correct order is  $0.86$ ,  $0.875$ ,  $0.7$ .

**Q3.** Determine whether  $-4.5 > -\frac{9}{2}$  is true or false using appropriate justification.

**Answer:** False

**Explanation:**  $-4.5 = -\frac{9}{2}$ , so they are equal, not greater.

**Q4.** Compare  $-1.2$  and  $-\frac{6}{5}$  using the correct inequality sign.

**Answer:**  $-1.2 = -\frac{6}{5}$

**Explanation:**  $-\frac{6}{5} = -1.2$  exactly.

**Q5.** Place the following numbers on a number line:  $-2.4$ ,  $-1\frac{3}{4}$ ,  $0$ ,  $1.25$ ,  $3\frac{1}{3}$ .

**Answer:**  $-2.4$ ,  $-1\frac{3}{4}$ ,  $0$ ,  $1.25$ ,  $3\frac{1}{3}$

**Explanation:** All values are correctly sequenced from least to greatest on a number line.

**Q6.** Write the following numbers in order from smallest to largest:  $-0.25$ ,  $\frac{1}{3}$ ,  $-\frac{2}{5}$ ,  $0.1$ .

**Answer:**  $-\frac{2}{5}$ ,  $-0.25$ ,  $0.1$ ,  $\frac{1}{3}$

**Explanation:**  $-\frac{2}{5} \approx -0.4$ , so smallest, and others increase in value.

**Q7.** Identify which number is greater:  $-7.6$  or  $-7\frac{1}{2}$ .

**Answer:**  $-7\frac{1}{2}$

**Explanation:**  $-7.5 > -7.6$  as it's closer to zero.

**Q8.** Convert the following mixed numbers to improper fractions and compare them:  $3\frac{1}{3}$  and  $\frac{10}{3}$ .

**Answer:**  $3\frac{1}{3} = \frac{10}{3} \rightarrow \frac{10}{3} = \frac{10}{3}$

**Explanation:** Both are equal when converted to improper fractions.

**Q9.** Fill in the blank with the correct symbol ( $=$ ,  $\neq$ ,  $<$ ,  $>$ ,  $\leq$ ,  $\geq$ ):  $-\frac{8}{3}$  \_\_\_\_  $-2.6$

**Answer:**  $-\frac{8}{3} < -2.6$

**Explanation:**  $-\frac{8}{3} \approx -2.666$ , which is less than  $-2.6$ .



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**Q10.** Which is greater: 5.06 or 5.0601? Show how place value supports your answer.

**Answer:** 5.0601

**Explanation:** The extra 0.0001 in 5.0601 makes it slightly greater.

**Q11.** Multiply:  $-4 \times 3.2$

**Answer:** -12.8

**Explanation:** Negative times positive gives a negative result.

**Q12.** Divide:  $-36 \div 4.5$

**Answer:** -8

**Explanation:**  $36 \div 4.5 = 8$ ; applying the sign gives -8.

**Q13.** Subtract:  $-3 \frac{1}{2} - 1 \frac{1}{4}$

**Answer:**  $-4 \frac{3}{4}$

**Explanation:** Subtracting a positive from a negative moves further left on the number line.

**Q14.** Add:  $-2.5 + 3 \frac{3}{4}$

**Answer:** 1.25

**Explanation:**  $3.75 - 2.5 = 1.25$

**Q15.** Simplify the expression:  $-6 + 4 - 3.2 + 1.7$

**Answer:** -3.5

**Explanation:** Combine:  $(-6 + 4) = -2$ ,  $(-3.2 + 1.7) = -1.5$ , then  $-2 + (-1.5) = -3.5$

**Q16.** Evaluate:  $\frac{5}{8} \times (-16)$

**Answer:** -10

**Explanation:**  $\frac{5}{8}$  of 16 = 10, and applying the sign = -10.

**Q17.** Calculate the product of  $-3 \frac{1}{3}$  and  $2 \frac{1}{2}$

**Answer:**  $-8 \frac{1}{3}$

**Explanation:** Convert to improper:  $(-10/3) \times (5/2) = -50/6 = -25/3 = -8 \frac{1}{3}$

**Q18.** Perform the division and give the answer as a mixed number:  $-7 \div 1 \frac{1}{4}$

**Answer:**  $-5 \frac{3}{4}$

**Explanation:**  $1 \frac{1}{4} = 5/4$ , so  $-7 \div 5/4 = -7 \times 4/5 = -28/5 = -5 \frac{3}{4}$

**Q19.** Add the following:  $-5 \frac{3}{4} + (-2 \frac{1}{3})$

**Answer:**  $-8 \frac{1}{12}$

**Explanation:** Convert and add:  $-23/4 + (-7/3) = (-69 - 28)/12 = -97/12 = -8 \frac{1}{12}$

**Q20.** Multiply the following decimals:  $-1.5 \times 0.06$

**Answer:** -0.09

**Explanation:**  $1.5 \times 0.06 = 0.09 \rightarrow$  with negative = -0.09



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**Q21.** Subtract -3.2 from 1.7

**Answer:** 4.9

**Explanation:**  $1.7 - (-3.2) = 1.7 + 3.2 = 4.9$

**Q22.** Evaluate:  $(-2 \frac{2}{3}) + (4 \frac{1}{3})$

**Answer:**  $1 \frac{2}{3}$

**Explanation:** Convert and add:  $-8/3 + 13/3 = 5/3 = 1 \frac{2}{3}$

**Q23.** Multiply:  $-\frac{2}{3} \times \frac{3}{4}$

**Answer:**  $-\frac{1}{2}$

**Explanation:**  $-2/3 \times 3/4 = -6/12 = -\frac{1}{2}$

**Q24.** Divide:  $4.2 \div (-0.3)$

**Answer:** -14

**Explanation:**  $4.2 \div 0.3 = 14 \rightarrow$  with sign = -14

**Q25.** Simplify and evaluate:  $(-2 \frac{1}{2}) - (-1 \frac{1}{3})$

**Answer:**  $-1 \frac{1}{6}$

**Explanation:**  $-5/2 + 4/3 = (-15 + 8)/6 = -7/6 = -1 \frac{1}{6}$

**Q26.** Add together:  $0.125 + 1/8 + \frac{3}{8}$

**Answer:** 0.625

**Explanation:**  $0.125 = 1/8$ , so  $1/8 + 1/8 + 3/8 = 5/8 = 0.625$

**Q27.** Find the difference:  $6 - 10.35$

**Answer:** -4.35

**Explanation:** Subtracting larger from smaller gives negative result.

**Q28.** Perform:  $(-12.6) \div (-0.9)$

**Answer:** 14

**Explanation:** Two negatives cancel:  $12.6 \div 0.9 = 14$

**Q29.** Evaluate the expression:  $(5.2 - 9.6) + (3.4)$

**Answer:** -1

**Explanation:**  $5.2 - 9.6 = -4.4$ ;  $-4.4 + 3.4 = -1$

**Q30.** Subtract a negative number:  $8.7 - (-1.3)$

**Answer:** 10

**Explanation:** Double negative becomes addition:  $8.7 + 1.3 = 10$

**Q31.** Compare and fill the blank:  $0.00045$  \_\_\_\_  $0.0045$

**Answer:** <

**Explanation:** 0.00045 has fewer tenths, hundredths, thousandths than 0.0045



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**Q32.** Convert and compare: Write 0.6 as a fraction and compare it with  $\frac{5}{8}$

**Answer:**  $0.6 = \frac{3}{5} > \frac{5}{8}$

**Explanation:**  $\frac{3}{5} = 0.6$ ,  $\frac{5}{8} = 0.625$ ; so  $0.6 < 0.625$

**Q33.** Calculate:  $-2.25 + 3.6 - 5.4$

**Answer:** -4.05

**Explanation:**  $-2.25 + 3.6 = 1.35$ ;  $1.35 - 5.4 = -4.05$

**Q34.** Use formal written methods to divide 7.84 by 0.4

**Answer:** 19.6

**Explanation:** Move decimal:  $78.4 \div 4 = 19.6$

**Q35.** Use place value to determine the value of the digit 7 in the number 407.062

**Answer:** 7

**Explanation:** The 7 is in the units place  $\rightarrow$  value is  $7 \times 1 = 7$

**Q36.** Multiply -0.02 by 10,000 and explain the shift in place value

**Answer:** -200

**Explanation:** Moving decimal 4 places right:  $-0.02 \times 10,000 = -200$

**Q37.** Divide:  $0.00072 \div 0.00009$

**Answer:** 8

**Explanation:** Shift decimals  $\rightarrow 72 \div 9 = 8$

**Q38.** Round 0.008673 to 2 decimal places and explain the reasoning

**Answer:** 0.01

**Explanation:** 2nd decimal is 0.00(8), next digit is 6  $\rightarrow$  round up

**Q39.** Add:  $-1.32 + 0.8 + (-3.5)$

**Answer:** -4.02

**Explanation:**  $-1.32 - 3.5 = -4.82$ , then  $+0.8 = -4.02$

**Q40.** Subtract:  $-0.625 - 0.25$

**Answer:** -0.875

**Explanation:** Subtracting a positive deepens the negative

**Q41.** Evaluate the expression using brackets:  $(-3.5 + 1.2) \times 4$

**Answer:** -9.2

**Explanation:** Inside = -2.3;  $\times 4 = -9.2$

**Q42.** Multiply the mixed numbers:  $1 \frac{1}{3} \times (-3 \frac{2}{3})$

**Answer:**  $-4 \frac{8}{9}$

**Explanation:**  $\frac{4}{3} \times -\frac{11}{3} = -\frac{44}{9} = -4 \frac{8}{9}$



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**Q43.** Simplify the following:  $-4/5 \times 10$

**Answer:** -8

**Explanation:**  $4/5 \times 10 = 8 \rightarrow$  apply sign

**Q44.** Write the decimal 0.00036 in standard form

**Answer:**  $3.6 \times 10^{-4}$

**Explanation:** Decimal moved 4 places to right

**Q45.** Convert the fraction  $11/8$  into a decimal and then compare it to 1.4

**Answer:**  $1.375 < 1.4$

**Explanation:**  $11 \div 8 = 1.375 < 1.4$

**Q46.** Compare and justify using place value:  $6.705$  \_\_\_\_  $6.750$

**Answer:** <

**Explanation:** Tenths same, hundredths 0 vs 5  $\rightarrow 6.705 < 6.750$

**Q47.** Multiply:  $0.004 \times (-0.6)$

**Answer:** -0.0024

**Explanation:** Product is 0.0024 with negative sign

**Q48.** Divide a negative by a positive:  $-81 \div 9$

**Answer:** -9

**Explanation:**  $81 \div 9 = 9$ , apply negative

**Q49.** Use long multiplication to calculate:  $-12.4 \times 3.1$

**Answer:** -38.44

**Explanation:**  $124 \times 31 = 3844 \rightarrow$  2 decimals  $\rightarrow -38.44$

**Q50.** Write 3.075 in words, and identify the place value of each digit

**Answer:** Three and seventy-five thousandths. 3 (units), 0 (tenths), 7 (hundredths), 5 (thousandths)

**Explanation:** Based on decimal position and standard reading format.

**Q51.** Simplify the expression:  $(3^2 + 4) \times (12 \div 3) - 5$

**Answer:** 25

**Explanation:**  $3^2 = 9 \rightarrow (9 + 4) = 13$ ;  $12 \div 3 = 4$ ; then  $13 \times 4 = 52$ ;  $52 - 5 = 47$ .

**Q52.** Given that  $72 = 2^3 \times 3^2$ , write down the prime factorisation of 144 in index form.

**Answer:**  $2^4 \times 3^2$

**Explanation:**  $144 = 12 \times 12 = (2^2 \times 3)^2 = 2^4 \times 3^2$

**Q53.** Find the lowest common multiple (LCM) of 18 and 24 using prime factorisation.

**Answer:** 72

**Explanation:**  $18 = 2 \times 3^2$ ;  $24 = 2^3 \times 3 \rightarrow \text{LCM} = 2^3 \times 3^2 = 72$



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**Q54.** Two numbers have a highest common factor (HCF) of 6 and a lowest common multiple (LCM) of 120. If one of the numbers is 24, find the other.

**Answer:** 30

**Explanation:**  $\text{HCF} \times \text{LCM} = \text{product of numbers} \rightarrow 6 \times 120 = 24 \times x \rightarrow x = 720 \div 24 = 30$

**Q55.** Without using a calculator, evaluate the expression:  $\sqrt{4^2 + 3^2}$

**Answer:** 5

**Explanation:**  $4^2 = 16, 3^2 = 9 \rightarrow 16 + 9 = 25 \rightarrow \sqrt{25} = 5$

**Q56.** If  $a \times b = 36$  and  $b = 9$ , use the inverse operation to find the value of  $a$ .

**Answer:** 4

**Explanation:**  $a = 36 \div 9 = 4$

**Q57.** Expand and simplify:  $5(2x - 3) - 3(x - 4)$

**Answer:**  $7x + 3$

**Explanation:**  $10x - 15 - 3x + 12 = 7x - 3$

**Q58.** Write 210 as a product of its prime factors using index notation.

**Answer:**  $2 \times 3 \times 5 \times 7$

**Explanation:**  $210 = 2 \times 105 \rightarrow 2 \times 3 \times 35 \rightarrow 2 \times 3 \times 5 \times 7$

**Q59.** A number is divisible by both 12 and 18. What is the smallest possible value of this number?

**Answer:** 36

**Explanation:**  $\text{LCM}(12, 18) = 2^2 \times 3^2 = 36$

**Q60.** Use the unique factorisation theorem to find the HCF of 84 and 126.

**Answer:** 42

**Explanation:**  $84 = 2^2 \times 3 \times 7; 126 = 2 \times 3^2 \times 7 \rightarrow \text{HCF} = 2 \times 3 \times 7 = 42$

**Q61.** Simplify the expression by cancelling common factors:  $(14x^2 - 21x) \div (7x)$

**Answer:**  $2x - 3$

**Explanation:** Factor numerator:  $7x(2x - 3)$ ; cancel  $7x \rightarrow \text{result} = 2x - 3$

**Q62.** Given that  $x = 5$ , evaluate the expression:  $2x^2 - 4x + 3$

**Answer:** 33

**Explanation:**  $2(25) - 20 + 3 = 50 - 20 + 3 = 33$

**Q63.** If  $3(x + 2) = 2(2x - 1)$ , solve for  $x$ .

**Answer:** 8

**Explanation:**  $3x + 6 = 4x - 2 \rightarrow -x = -8 \rightarrow x = 8$

**Q64.** The reciprocal of a number is  $\frac{2}{3}$ . What is the original number?

**Answer:**  $\frac{3}{2}$

**Explanation:** Reciprocal of  $\frac{2}{3} = \frac{3}{2}$



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**Q65.** Simplify the following using the laws of indices:  $(2^3 \times 2^4) \div 2^2$

**Answer:**  $2^5$

**Explanation:**  $2^3 \times 2^4 = 2^7$ ; then  $\div 2^2 = 2^5$

**Q66.** Evaluate the expression:  $[5 + 3 \times (2^2)] - 6$

**Answer:** 11

**Explanation:**  $2^2 = 4$ ;  $3 \times 4 = 12$ ;  $5 + 12 = 17$ ;  $17 - 6 = 11$

**Q67.** Find the value of x in the equation:  $x^2 = 121$

**Answer:**  $x = \pm 11$

**Explanation:**  $\sqrt{121} = 11 \rightarrow$  both positive and negative roots valid

**Q68.** Using product notation, express the prime factorisation of 1000

**Answer:**  $2^3 \times 5^3$

**Explanation:**  $1000 = 10^3 = (2 \times 5)^3 = 2^3 \times 5^3$

**Q69.** Explain why the square root of a prime number is always irrational

**Answer:** Because prime numbers cannot be expressed as the square of a rational number, their square roots are non-terminating, non-repeating decimals.

**Q70.** The HCF of two numbers is 15 and their LCM is 180. If one number is 45, determine the other using the relationship between HCF, LCM and product of two numbers.

**Answer:** 60

**Explanation:**  $\text{HCF} \times \text{LCM} = \text{product} \rightarrow 15 \times 180 = 2700 = 45 \times x \rightarrow x = 60$

**Q71.** List all the different two-digit numbers that can be made using the digits 3, 5, and 7, without repeating digits

**Answer:** 35, 37, 53, 57, 73, 75

**Solution:** Choose 2 different digits from 3, 5, and 7. Total =  $3 \times 2 = 6$  combinations.

**Q72.** How many different ways can you arrange the letters in the word "CUBE"?

**Answer:** 24

**Solution:** 4 distinct letters  $\rightarrow 4! = 4 \times 3 \times 2 \times 1 = 24$

**Q73.** Simplify:  $2^4 \times 2^3$

**Answer:**  $2^7 = 128$

**Solution:** When bases are the same, add powers:  $2^4 \times 2^3 = 2^{(4+3)} = 2^7$

**Q74.** Simplify:  $(3^2)^3$

**Answer:** 729

**Solution:**  $(3^2)^3 = 3^{(2 \times 3)} = 3^6 = 729$



**MEGA**

**LECTURE**

**Q75. Write down the value of  $5^0$**

**Answer:** 1

**Solution:** Any non-zero number raised to the power 0 equals 1

**Q76. Calculate the exact value of  $64^{(1/3)}$**

**Answer:** 4

**Solution:** Cube root of 64 is 4 because  $4^3 = 64$

**Q77. Without using a calculator, work out the value of  $4^{(3/2)}$**

**Answer:** 8

**Solution:**  $4^{(3/2)} = (\sqrt{4})^3 = 2^3 = 8$

**Q78. Simplify:  $(\sqrt{5})^2$**

**Answer:** 5

**Solution:** Square of a square root gives the number:  $(\sqrt{5})^2 = 5$

**Q79. Simplify:  $3\sqrt{2} + 2\sqrt{2}$**

**Answer:**  $5\sqrt{2}$

**Solution:** Add like terms:  $3\sqrt{2} + 2\sqrt{2} = (3+2)\sqrt{2} = 5\sqrt{2}$

**Q80. Simplify:  $\sqrt{50}$**

**Answer:**  $5\sqrt{2}$

**Solution:**  $\sqrt{50} = \sqrt{(25 \times 2)} = \sqrt{25} \times \sqrt{2} = 5\sqrt{2}$

**Q81. Write  $\sqrt{12}$  in its simplest surd form**

**Answer:**  $2\sqrt{3}$

**Solution:**  $\sqrt{12} = \sqrt{(4 \times 3)} = \sqrt{4} \times \sqrt{3} = 2\sqrt{3}$

**Q82. Rationalise the denominator:  $3 / \sqrt{2}$**

**Answer:**  $(3\sqrt{2}) / 2$

**Solution:** Multiply numerator and denominator by  $\sqrt{2}$ :  $(3 / \sqrt{2}) \times (\sqrt{2} / \sqrt{2}) = 3\sqrt{2} / 2$

**Q83. Rationalise and simplify:  $4 / \sqrt{5}$**

**Answer:**  $(4\sqrt{5}) / 5$

**Solution:** Multiply by  $\sqrt{5}$ :  $(4 / \sqrt{5}) \times (\sqrt{5} / \sqrt{5}) = 4\sqrt{5} / 5$

**Q84. Simplify:  $(\sqrt{3})^2 + \sqrt{9}$**

**Answer:**  $3 + 3 = 6$

**Solution:**  $(\sqrt{3})^2 = 3$  and  $\sqrt{9} = 3 \rightarrow 3 + 3 = 6$

**Q85. Expand and simplify:  $(\sqrt{2} + \sqrt{3})^2$**

**Answer:**  $5 + 2\sqrt{6}$

**Solution:** Use  $(a + b)^2 = a^2 + 2ab + b^2 \rightarrow (\sqrt{2})^2 + 2\sqrt{2}\sqrt{3} + (\sqrt{3})^2 = 2 + 2\sqrt{6} + 3 = 5 + 2\sqrt{6}$

**LECTURE**

**Q86. Simplify the expression:  $(2\sqrt{3})(5\sqrt{6})$**

**Answer:**  $10\sqrt{18} = 30\sqrt{2}$

**Solution:** Multiply constants and roots:  $2 \times 5 = 10$ ,  $\sqrt{3} \times \sqrt{6} = \sqrt{18} = 3\sqrt{2} \rightarrow 10 \times 3\sqrt{2} = 30\sqrt{2}$

**Q87. Simplify:  $\sqrt{a} \times \sqrt{b}$**

**Answer:**  $\sqrt{ab}$

**Solution:** Product of square roots = square root of the product

**Q88. Simplify and give your answer in terms of surds:  $\sqrt{(27 \times 12)}$**

**Answer:** 18

**Solution:**  $27 \times 12 = 324 \rightarrow \sqrt{324} = 18$

**Q89. Write  $8^{(2/3)}$  as a surd**

**Answer:**  $(\sqrt[3]{8})^2 = 2^2 = 4$

**Solution:**  $8^{(2/3)} = (8^{(1/3)})^2 = 2^2 = 4$

**Q90. Simplify:  $(16)^{(3/4)}$**

**Answer:** 8

**Solution:**  $16^{(3/4)} = (\sqrt[4]{16})^3 = (2)^3 = 8$

**Q91. Evaluate:  $(81)^{(1/4)}$**

**Answer:** 3

**Solution:** Fourth root of 81 = 3, because  $3^4 = 81$

**Q92. Simplify:  $(x^3)^{(1/2)}$**

**Answer:**  $x^{(3/2)}$

**Solution:** Multiply powers:  $(x^3)^{(1/2)} = x^{(3 \times 1/2)} = x^{(3/2)}$

**Q93. Work out the exact value of  $\pi \times 6^2$**

**Answer:**  $36\pi$

**Solution:**  $6^2 = 36$ , so  $\pi \times 36 = 36\pi$

**Q94. Give an exact value for the area of a circle with radius 3 cm, in terms of  $\pi$**

**Answer:**  $9\pi \text{ cm}^2$

**Solution:** Area =  $\pi r^2 = \pi \times 3^2 = \pi \times 9 = 9\pi$

**Q95. Calculate exactly:  $(2/3)^2$**

**Answer:**  $4/9$

**Solution:**  $(2/3)^2 = 4/9$

**Q96. Simplify:  $(x^2 \times x^3) / x^4$**

**Answer:**  $x$

**Solution:**  $x^2 \times x^3 = x^5 \rightarrow x^5 / x^4 = x$

## LECTURE

**Q97. Simplify fully:  $5\sqrt{18} - \sqrt{50}$**

**Answer:**  $15\sqrt{2} - 5\sqrt{2} = 10\sqrt{2}$

**Solution:**  $\sqrt{18} = 3\sqrt{2}$ ,  $\sqrt{50} = 5\sqrt{2} \rightarrow 5 \times 3\sqrt{2} - 5\sqrt{2} = 15\sqrt{2} - 5\sqrt{2} = 10\sqrt{2}$

**Q98. Expand and simplify:  $(\sqrt{3} + 1)(\sqrt{3} - 1)$**

**Answer:** 2

**Solution:** Use  $(a + b)(a - b) = a^2 - b^2 \rightarrow (\sqrt{3})^2 - 1^2 = 3 - 1 = 2$

**Q99. Simplify:  $(x^{1/2})^2$**

**Answer:** x

**Solution:** Multiply powers:  $x^{(1/2 \times 2)} = x^1 = x$

**Q100. Express  $125^{2/3}$  as a whole number**

**Answer:** 25

**Solution:**  $125^{2/3} = (\sqrt[3]{125})^2 = 5^2 = 25$

**Q101. Simplify:  $\sqrt{a^2}$**

**Answer:** |a|

**Solution:**  $\sqrt{a^2} = |a|$  (absolute value of a)

**Q102. Simplify:  $(a^{1/2} \times a^{1/3})$**

**Answer:**  $a^{5/6}$

**Solution:** Add powers:  $a^{(1/2 + 1/3)} = a^{(3/6 + 2/6)} = a^{5/6}$

**Q103. Expand and simplify:  $(2 + \sqrt{5})(2 - \sqrt{5})$**

**Answer:** -1

**Solution:** Use difference of squares:  $2^2 - (\sqrt{5})^2 = 4 - 5 = -1$

**Q104. Work out the cube root of 0.008**

**Answer:** 0.2

**Solution:**  $0.2^3 = 0.008 \rightarrow \sqrt[3]{0.008} = 0.2$

**Q105. Simplify:  $1 / \sqrt{8}$**

**Answer:**  $\sqrt{8} / 8$

**Solution:** Multiply by  $\sqrt{8}$ :  $(1 / \sqrt{8}) \times (\sqrt{8} / \sqrt{8}) = \sqrt{8} / 8$

**Q106. Rationalise the denominator and simplify:  $5 / (2\sqrt{3})$**

**Answer:**  $(5\sqrt{3}) / 6$

**Solution:** Multiply by  $\sqrt{3}$ :  $(5 / 2\sqrt{3}) \times (\sqrt{3} / \sqrt{3}) = 5\sqrt{3} / (2 \times 3) = 5\sqrt{3} / 6$

**Q107. Simplify:  $(9x^2)^{1/2}$**

**Answer:** 3x

**Solution:**  $\sqrt{(9x^2)} = \sqrt{9} \times \sqrt{x^2} = 3x$



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**Q108. Evaluate:  $(x^{(3/2)}) / (x^{(1/2)})$**

**Answer:**  $x$

**Solution:** Subtract powers:  $x^{(3/2 - 1/2)} = x^1 = x$

**Q109. Write the number 64 as a power of 4**

**Answer:**  $4^3$

**Solution:**  $4^3 = 64$

**Q110. Simplify:  $(\sqrt{27} + \sqrt{3})^2$**

**Answer:**  $30 + 6\sqrt{3}$

**Solution:**  $\sqrt{27} = 3\sqrt{3} \rightarrow (3\sqrt{3} + \sqrt{3})^2 = (4\sqrt{3})^2 = 16 \times 3 = 48$  (Correction: Let's expand properly:)

Use  $(a + b)^2 = a^2 + 2ab + b^2$

$\rightarrow (\sqrt{27} + \sqrt{3})^2 = 27 + 2\sqrt{81} + 3 = 27 + 18 + 3 = 48$

**Q111. Simplify:  $\sqrt{(3^2 + 4^2)}$**

**Answer:** 5

**Solution:**  $3^2 + 4^2 = 9 + 16 = 25 \rightarrow \sqrt{25} = 5$

**Q112. Calculate exactly:  $\pi \times 12$**

**Answer:**  $12\pi$

**Solution:** Just multiply:  $\pi \times 12 = 12\pi$

**Q113. Simplify:  $(x^{(2/3)})^3$**

**Answer:**  $x^2$

**Solution:** Multiply powers:  $x^{(2/3 \times 3)} = x^2$

**Q114. Simplify:  $(x^{(1/4)})^2$**

**Answer:**  $x^{(1/2)}$

**Solution:** Multiply powers:  $x^{(1/4 \times 2)} = x^{(1/2)}$

**Q115. Express 32 as a power of 2**

**Answer:**  $2^5$

**Solution:**  $2^5 = 32$

**Q116. Write down all the square numbers less than 100**

**Answer:** 1, 4, 9, 16, 25, 36, 49, 64, 81

**Solution:** Squares of numbers  $1^2$  to  $9^2$

**Q117. Simplify:  $\sqrt{48} + \sqrt{75}$**

**Answer:**  $4\sqrt{3} + 5\sqrt{3} = 9\sqrt{3}$

**Solution:**  $\sqrt{48} = 4\sqrt{3}$ ,  $\sqrt{75} = 5\sqrt{3} \rightarrow$  Add:  $9\sqrt{3}$

**Q118. Rationalise the denominator and simplify:  $(6 + \sqrt{2}) / \sqrt{2}$**

**Answer:**  $(6\sqrt{2} + 2) / 2$

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**Solution:** Multiply numerator and denominator by  $\sqrt{2}$ :

$$(6 + \sqrt{2})/\sqrt{2} \times (\sqrt{2}/\sqrt{2}) = (6\sqrt{2} + 2)/2$$

**Q119. Simplify:**  $\sqrt{(2a)} \times \sqrt{(8a)}$

**Answer:**  $\sqrt{(16a^2)} = 4a$

**Solution:** Multiply inside roots:  $\sqrt{(2a \times 8a)} = \sqrt{(16a^2)} = 4a$

**Q120. Expand and simplify:**  $(x + \sqrt{2})(x - \sqrt{2})$

**Answer:**  $x^2 - 2$

**Solution:** Use  $(a + b)(a - b) = a^2 - b^2 \rightarrow x^2 - (\sqrt{2})^2 = x^2 - 2$

**Q121. Express 3,600,000 in standard form**

**Answer:**  $3.6 \times 10^6$

**Solution:** Move the decimal point 6 places to the left to get a number between 1 and 10:  $3.6 \times 10^6$

**Q122. Write  $7.25 \times 10^{-3}$  as an ordinary number**

**Answer:** 0.00725

**Solution:** Move the decimal point 3 places to the left:  $7.25 \rightarrow 0.00725$

**Q123. A car travels  $3.2 \times 10^5$  metres in  $4 \times 10^2$  seconds. Work out the average speed in standard form**

**Answer:**  $8 \times 10^2$  m/s

**Solution:**  $(3.2 \times 10^5) \div (4 \times 10^2) = (3.2 \div 4) \times 10^{(5-2)} = 0.8 \times 10^3 = 8 \times 10^2$

**Q124. Multiply  $(6.4 \times 10^4)$  by  $(5 \times 10^3)$  and give your answer in standard form**

**Answer:**  $3.2 \times 10^8$

**Solution:**  $(6.4 \times 5) \times 10^{(4+3)} = 32 \times 10^7 = 3.2 \times 10^8$

**Q125. Divide  $(8.1 \times 10^6)$  by  $(3 \times 10^2)$  and write the answer in standard form**

**Answer:**  $2.7 \times 10^4$

**Solution:**  $(8.1 \div 3) \times 10^{(6-2)} = 2.7 \times 10^4$

**Q126. A bacteria population doubles every hour. Initially, there are  $4.5 \times 10^3$  bacteria. How many will there be after 3 hours?**

**Answer:**  $3.6 \times 10^4$

**Solution:** Double 3 times:  $4.5 \times 2^3 = 4.5 \times 8 = 36 \times 10^3 = 3.6 \times 10^4$

**Q127. Convert 0.875 into a fraction in its simplest form**

**Answer:**  $7/8$

**Solution:**  $0.875 = 875/1000 = 7/8$  after simplification

**Q128. Write  $11/4$  as a decimal**

**Answer:** 2.75

**Solution:**  $11 \div 4 = 2.75$



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**Q129. A drink contains 0.6 litres of water. Express this as a fraction of a litre**

**Answer:**  $3/5$

**Solution:**  $0.6 = 6/10 = 3/5$

**Q130. Convert the recurring decimal 0.333... into a fraction**

**Answer:**  $1/3$

**Solution:** Let  $x = 0.333\dots$ , then  $10x = 3.333\dots$ , subtract to get  $9x = 3 \rightarrow x = 1/3$

**Q131. A chocolate bar weighs 0.375 kg. Express this weight as a fraction in its simplest form**

**Answer:**  $3/8$

**Solution:**  $0.375 = 375/1000 = 3/8$

**Q132. Write  $2 \frac{3}{8}$  as a decimal**

**Answer:** 2.375

**Solution:**  $3/8 = 0.375 \rightarrow 2 + 0.375 = 2.375$

**Q133. A packet contains 0.25 kg of nuts. If each serving is  $1/8$  kg, how many servings are there?**

**Answer:** 2

**Solution:**  $0.25 = 1/4 \rightarrow (1/4) \div (1/8) = 2$

**Q134. Convert the decimal 1.2 into a mixed number**

**Answer:**  $1 \frac{1}{5}$

**Solution:**  $0.2 = 1/5 \rightarrow 1.2 = 1 \frac{1}{5}$

**Q135. Express  $5/6$  as a decimal, giving your answer to 3 decimal places**

**Answer:** 0.833

**Solution:**  $5 \div 6 = 0.833\dots$

**Q136. Divide £2.40 between Alice and Ben in the ratio 3:5. How much does each receive?**

**Answer:** Alice = £0.90, Ben = £1.50

**Solution:**  $3+5=8$  parts.  $£2.40 \div 8 = £0.30$  per part  $\rightarrow$  Alice:  $3 \times 0.30 = £0.90$ , Ben:  $5 \times 0.30 = £1.50$

**Q137. Simplify the ratio  $6/10 : 9/15$**

**Answer:** 1:1

**Solution:**  $6/10 = 3/5$ ,  $9/15 = 3/5 \rightarrow$  ratio =  $3/5 : 3/5 = 1:1$

**Q138. Divide 42 grams of gold into the ratio  $1/3 : 2/3$**

**Answer:** 14 g : 28 g

**Solution:** Total =  $1/3 + 2/3 = 1$ . Divide  $42 \times (1/3) = 14$ , and  $42 \times (2/3) = 28$

**Q139. A recipe uses  $3/4$  of a cup of sugar to  $1/2$  a cup of oil. Write this as a ratio in its simplest form**



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**Answer:** 3:2

**Solution:**  $(3/4):(1/2) = (3/4) \div (1/2) = 3/4 \times 2/1 = 6/4 = 3:2$

**Q140. Divide 500ml of a drink in the ratio 2/5 : 3/5**

**Answer:** 200ml : 300ml

**Solution:**  $2/5 \times 500 = 200$ ,  $3/5 \times 500 = 300$

**Q141. There are 36 students in a class. The ratio of boys to girls is 5/9 : 4/9. How many boys are there?**

**Answer:** 20

**Solution:**  $5/9 + 4/9 = 1 \rightarrow \text{boys} = 5/9 \times 36 = 20$

**Q142. A map uses the ratio 1:50,000. What is the actual distance (in km) represented by 3.2 cm on the map?**

**Answer:** 1.6 km

**Solution:**  $3.2 \times 50,000 = 160,000 \text{ cm} = 1.6 \text{ km}$

**Q143. Increase 120 by 15%**

**Answer:** 138

**Solution:**  $15\% \text{ of } 120 = 18 \rightarrow 120 + 18 = 138$

**Q144. Decrease £180 by 20%**

**Answer:** £144

**Solution:**  $20\% \text{ of } 180 = 36 \rightarrow 180 - 36 = 144$

**Q145. A coat is reduced in a sale by 30%. If the sale price is £84, what was the original price?**

**Answer:** £120

**Solution:** Let original =  $x \rightarrow 70\% \text{ of } x = 84 \rightarrow 0.7x = 84 \rightarrow x = 120$

**Q146. A bank pays 2% interest annually. How much interest is earned on £450 over one year?**

**Answer:** £9

**Solution:**  $2\% \text{ of } £450 = (2/100) \times 450 = £9$

**Q147. 25% of a number is 60. What is the number?**

**Answer:** 240

**Solution:** Let  $x$  be the number  $\rightarrow 0.25x = 60 \rightarrow x = 240$

**Q148. 80 is what percentage of 320?**

**Answer:** 25%

**Solution:**  $(80 \div 320) \times 100 = 25\%$

**Q149. Express 48 as a percentage of 80**

**Answer:** 60%

**Solution:**  $(48 \div 80) \times 100 = 60\%$



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**Q150. A factory increases its production by 12% each year. If it produced 5,000 units this year, how many will it produce next year?**

**Answer:** 5,600

**Solution:**  $12\%$  of 5000 = 600  $\rightarrow$  5000 + 600 = 5600

**Q151. A worker earns £9.60 per hour. How much does she earn in 37.5 hours?**

**Answer:** £360

**Solution:**  $9.60 \times 37.5 = \text{£}360$

**Q152. A bag of flour weighs 2.5 kg. How many 0.2 kg loaves can be made from it?**

**Answer:** 12

**Solution:**  $2.5 \div 0.2 = 12.5 \rightarrow$  12 full loaves

**Q153. Convert 1.75 metres into centimetres**

**Answer:** 175 cm

**Solution:** 1 m = 100 cm  $\rightarrow$   $1.75 \times 100 = 175$

**Q154. A journey takes 2.5 hours. Express this time in minutes**

**Answer:** 150 minutes

**Solution:**  $2.5 \times 60 = 150$

**Q155. Convert 0.85 litres into millilitres**

**Answer:** 850 ml

**Solution:** 1 litre = 1000 ml  $\rightarrow$   $0.85 \times 1000 = 850$

**Q156. A container holds 2.4 litres of water. How many 300 ml cups can be filled?**

**Answer:** 8

**Solution:** 2.4 L = 2400 ml  $\rightarrow$   $2400 \div 300 = 8$

**Q157. A car travels 180 km in 2.5 hours. Calculate its average speed in km/h**

**Answer:** 72 km/h

**Solution:**  $180 \div 2.5 = 72$

**Q158. A sprinter runs 100 metres in 9.58 seconds. Calculate their average speed in m/s**

**Answer:** 10.44 m/s

**Solution:**  $100 \div 9.58 \approx 10.44$

**Q159. A rectangle has length 2.4 m and width 1.5 m. Find its area in m<sup>2</sup>**

**Answer:** 3.6 m<sup>2</sup>

**Solution:**  $2.4 \times 1.5 = 3.6$

**Q160. A water tank has a volume of 1.2 m<sup>3</sup>. Convert this volume to litres**

**Answer:** 1200 litres

**Solution:** 1 m<sup>3</sup> = 1000 litres  $\rightarrow$   $1.2 \times 1000 = 1200$



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**Q161. A cyclist covers 36 km in 1.5 hours. What is their speed in m/s?**

**Answer:** 6.67 m/s

**Solution:** 36 km = 36,000 m; 1.5 hrs = 5400 s →  $36000 \div 5400 \approx 6.67$

**Q162. A van travels 225 miles in 3.75 hours. Find its average speed in mph**

**Answer:** 60 mph

**Solution:**  $225 \div 3.75 = 60$

**Q163. Convert 5 minutes 30 seconds into seconds**

**Answer:** 330 seconds

**Solution:**  $(5 \times 60) + 30 = 300 + 30 = 330$

**Q164. A recipe needs 0.75 kg of flour. You only have 375 g. What fraction of the required flour do you have?**

**Answer:** 1/2

**Solution:**  $0.75 \text{ kg} = 750 \text{ g} \rightarrow 375 \div 750 = 1/2$

**Q165. A road is 2.8 miles long. Convert this length into kilometres (1 mile = 1.609 km)**

**Answer:** 4.5052 km

**Solution:**  $2.8 \times 1.609 \approx 4.5052$

**Q166. A tank fills at a rate of 1.5 litres per second. How much water will it contain after 4 minutes?**

**Answer:** 360 litres

**Solution:** 4 minutes = 240 seconds →  $1.5 \times 240 = 360$

**Q167. A car uses 45 litres of fuel to travel 540 km. Calculate its fuel efficiency in km/litre**

**Answer:** 12 km/litre

**Solution:**  $540 \div 45 = 12$

**Q168. A rectangular field is 0.5 km long and 300 m wide. Find the area in m<sup>2</sup>**

**Answer:** 150,000 m<sup>2</sup>

**Solution:** 0.5 km = 500 m →  $500 \times 300 = 150,000$

**Q169. Convert 0.0045 m to millimetres**

**Answer:** 4.5 mm

**Solution:**  $0.0045 \text{ m} = 0.0045 \times 1000 = 4.5 \text{ mm}$

**Q170. A person earns £2,500 per month. Calculate their annual income**

**Answer:** £30,000

**Solution:**  $2500 \times 12 = 30,000$



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**Q171. Estimate the value of  $49.3 \times 0.81$  by rounding each number to 1 significant figure**

**Answer:**  $50 \times 0.8 = 40$

**Solution:**  $49.3 \approx 50$ ,  $0.81 \approx 0.8 \rightarrow 50 \times 0.8 = 40$

**Q172. Without using a calculator, estimate the value of  $\sqrt{82}$  by comparing it with two nearby square numbers**

**Answer:** Between 9 and 10

**Solution:**  $81 = 9^2$  and  $100 = 10^2$ , so  $\sqrt{82}$  is slightly more than 9

**Q173. Round 0.04856 to 2 significant figures**

**Answer:** 0.049

**Solution:** First two significant figures are 4 and 8, next digit is 5  $\rightarrow$  round up

**Q174. Round 6.295 to 2 decimal places**

**Answer:** 6.30

**Solution:** 3rd decimal is 5  $\rightarrow$  round the second decimal place up

**Q175. Round 13,475 to the nearest hundred**

**Answer:** 13,500

**Solution:** Tens digit is 7  $\rightarrow$  round up

**Q176. A length is measured as 7.56 cm to the nearest 0.01 cm. Write the error interval for the actual length**

**Answer:**  $7.555 \text{ cm} \leq \text{length} < 7.565 \text{ cm}$

**Solution:**  $\pm 0.005$  from 7.56 gives interval from 7.555 to just under 7.565

**Q177. A car's mass is recorded as 1,350 kg to the nearest 10 kg. State the lower and upper bounds for the mass**

**Answer:**  $1,345 \text{ kg} \leq \text{mass} < 1,355 \text{ kg}$

**Solution:**  $\pm 5 \text{ kg}$  gives lower and upper bounds

**Q178. The width of a table is given as 85.3 cm, measured to the nearest 0.1 cm. Write this measurement as an error interval using inequality notation**

**Answer:**  $85.25 \text{ cm} \leq \text{width} < 85.35 \text{ cm}$

**Solution:**  $\pm 0.05$  from 85.3 gives the range

**Q179. A time is recorded as 3.6 s to 1 decimal place. State the upper bound for the time**

**Answer:** 3.65 s

**Solution:** Add 0.05 to 3.6 to get upper bound

**Q180. A temperature is recorded as  $-2.4^\circ\text{C}$  to the nearest tenth of a degree. Write the error interval using inequality notation**

**Answer:**  $-2.45^\circ\text{C} \leq \text{temperature} < -2.35^\circ\text{C}$

**Solution:**  $\pm 0.05$  from  $-2.4$  gives the bounds



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**Q181. A student calculates  $23.9 \times 1.06 = 25.334$ . Use estimation to check if this result is reasonable**

**Answer:** Yes, it is reasonable

**Solution:** Estimate:  $24 \times 1 = 24 \rightarrow 25.334$  is close

**Q182. A value is given as 2.938 to 3 decimal places. Round this to 2 significant figures**

**Answer:** 2.9

**Solution:** First two significant digits are 2 and 9  $\rightarrow$  next digit is 3, so no rounding up

**Q183. Round the number 0.000849 to 2 significant figures**

**Answer:** 0.00085

**Solution:** First two significant digits are 8 and 4, third is 9  $\rightarrow$  round up

**Q184. A measurement is given as 12.08 cm. State the upper and lower bounds if it was rounded to the nearest 0.01 cm**

**Answer:**  $12.075 \text{ cm} \leq \text{length} < 12.085 \text{ cm}$

**Solution:**  $\pm 0.005$  from 12.08

**Q185. A mobile phone weighs 173 g to the nearest gram. Write the error interval for the weight**

**Answer:**  $172.5 \text{ g} \leq \text{weight} < 173.5 \text{ g}$

**Solution:**  $\pm 0.5 \text{ g}$  around 173 g

**Q186. A distance is measured as 2.7 km to 1 decimal place. Use inequality notation to write the error interval**

**Answer:**  $2.65 \text{ km} \leq \text{distance} < 2.75 \text{ km}$

**Solution:**  $\pm 0.05 \text{ km}$  around 2.7

**Q187. A box contains approximately 496 nails. Estimate how many nails would be in 25 such boxes**

**Answer:** About 12,500

**Solution:** Estimate  $496 \approx 500 \rightarrow 500 \times 25 = 12,500$

**Q188. Use rounding to estimate the result of  $(23.7 \times 4.9) \div 11.2$**

**Answer:**  $\approx 10$

**Solution:** Round to  $24 \times 5 = 120 \rightarrow 120 \div 12 = 10$

**Q189. A machine cuts steel rods to a length of 52.3 cm. The actual lengths can vary by up to 0.2 cm. Write the range of possible lengths using inequality notation**

**Answer:**  $52.1 \text{ cm} \leq \text{length} \leq 52.5 \text{ cm}$

**Solution:**  $\pm 0.2 \text{ cm}$  gives full inclusive range

**Q190. A student used a calculator to work out  $\sqrt{(103 \times 4.2)}$ . Check whether the answer 20.8 is reasonable by estimation**



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**Answer:** Yes

**Solution:** Estimate:  $100 \times 4 = 400 \rightarrow \sqrt{400} = 20 \rightarrow 20.8$  is close

**Q191. Estimate the value of  $38.6 \div 1.93$  by rounding both numbers appropriately**

**Answer:**  $\approx 40 \div 2 = 20$

**Solution:** Estimate values and divide

**Q192. The capacity of a tank is recorded as 245 litres, rounded to the nearest 5 litres. Determine the lower and upper bounds for the capacity**

**Answer:**  $242.5 \text{ L} \leq \text{capacity} < 247.5 \text{ L}$

**Solution:**  $\pm 2.5$  around 245

**Q193. Round 0.006728 to 3 significant figures**

**Answer:** 0.00673

**Solution:** Digits: 6, 7, 2; next is 8  $\rightarrow$  round up

**Q194. A measurement is recorded as 4.35 m to 2 decimal places. Use inequality notation to state the range within which the actual value lies**

**Answer:**  $4.345 \text{ m} \leq \text{value} < 4.355 \text{ m}$

**Solution:**  $\pm 0.005$  from 4.35

**Q195. A pencil is said to be 17.4 cm long to the nearest millimetre. Write the error interval**

**Answer:**  $17.35 \text{ cm} \leq \text{length} < 17.45 \text{ cm}$

**Solution:**  $\pm 0.05 \text{ cm}$

**Q196. A school recorded attendance as 94.6% to 1 decimal place. Give the error interval using inequalities**

**Answer:**  $94.55\% \leq \text{attendance} < 94.65\%$

**Solution:**  $\pm 0.05\%$  from 94.6%

**Q197. A phone battery capacity is listed as 3000 mAh, rounded to the nearest 100 mAh. What are the upper and lower bounds?**

**Answer:**  $2950 \text{ mAh} \leq \text{capacity} < 3050 \text{ mAh}$

**Solution:**  $\pm 50 \text{ mAh}$  from 3000

**Q198. Use estimation to check the result of  $(0.84 \times 19.6) + (3.92 \div 0.19)$**

**Answer:**  $\approx 97$

**Solution:** Estimate:  $0.8 \times 20 = 16$ ,  $4 \div 0.2 = 20 \rightarrow 16 + 20 = 36$

**Q199. Round 8.6297 to 3 significant figures**

**Answer:** 8.63

**Solution:** First three digits are 8, 6, 2  $\rightarrow$  next is 9  $\rightarrow$  round up



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**Q200. Round 563.48 to 1 significant figure**

**Answer:** 600

**Solution:** First digit 5 → next is 6 → round up

**Q201. A board is measured as 1.25 m wide. If it was rounded to the nearest 0.01 m, give its possible range using an inequality**

**Answer:**  $1.245 \text{ m} \leq \text{width} < 1.255 \text{ m}$

**Solution:**  $\pm 0.005 \text{ m}$  from 1.25

**Q202. The area of a square is calculated as  $25.6 \text{ cm}^2$ , based on a rounded side length.**

**Estimate the side length and check if the area is plausible**

**Answer:**  $\approx 5.1 \text{ cm}$

**Solution:**  $\sqrt{25.6} \approx 5.06 \rightarrow$  makes sense

**Q203. A child's height is measured as 1.32 m to 2 decimal places. Write the upper and lower bounds using inequality notation**

**Answer:**  $1.315 \text{ m} \leq \text{height} < 1.325 \text{ m}$

**Solution:**  $\pm 0.005 \text{ m}$

**Q204. A builder needs 15 planks, each 2.05 m long. Estimate the total length of wood required**

**Answer:**  $\approx 30 \text{ m}$

**Solution:**  $2.05 \approx 2 \rightarrow 15 \times 2 = 30$

**Q205. A laptop weighs 2.78 kg to 2 decimal places. Give the range of values it could actually weigh using inequalities**

**Answer:**  $2.775 \text{ kg} \leq \text{weight} < 2.785 \text{ kg}$

**Solution:**  $\pm 0.005 \text{ kg}$  from 2.78

**Q206. A number is measured as 0.0048 to 2 significant figures. Write the number rounded to 1 significant figure**

**Answer:** 0.005

**Solution:** First sig fig is 4, next is 8 → round up

**Q207. A recipe needs 0.62 litres of milk, measured to 2 decimal places. Write the error interval using inequalities**

**Answer:**  $0.615 \text{ L} \leq \text{volume} < 0.625 \text{ L}$

**Solution:**  $\pm 0.005 \text{ L}$

**Q208. Estimate the answer to  $48.1 \times 1.94$  by rounding to 1 significant figure**

**Answer:**  $\approx 50 \times 2 = 100$

**Solution:** Simple rounding and multiplication

**Q209. A square has a side length of 7.4 cm, measured to the nearest millimetre. Find the lower and upper bounds for the area**



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**Answer:**  $7.35^2 = 54.0225 \text{ cm}^2$ ,  $7.45^2 = 55.5025 \text{ cm}^2$

**Solution:** Square the lower and upper bounds of the side length

**Q210. A cuboid's dimensions are 12.3 cm, 4.5 cm, and 6.8 cm, all measured to the nearest 0.1 cm. Find the upper bound of the volume**

**Answer:**  $12.35 \times 4.55 \times 6.85 \approx 384.6 \text{ cm}^3$

**Solution:** Use upper bounds for all dimensions

**Q211. A student writes 3.4591 to 4 significant figures. What is the rounded number?**

**Answer:** 3.459

**Solution:** 5 is 4th sig fig, next is 1  $\rightarrow$  no change

**Q212. Round the number 0.0003784 to 2 significant figures**

**Answer:** 0.00038

**Solution:** 3 and 7 are sig figs, 8 rounds 7 up

**Q213. A measurement is recorded as 42.0 m, rounded to the nearest metre. State the range of values it could represent using inequalities**

**Answer:**  $41.5 \text{ m} \leq \text{value} < 42.5 \text{ m}$

**Solution:**  $\pm 0.5$  from 42.0

**Q214. A time is recorded as 2 minutes 15 seconds. Estimate how many such times would occur in an hour**

**Answer:**  $\approx 26$

**Solution:**  $2 \text{ min } 15 \text{ sec} = 135 \text{ sec} \rightarrow 3600 \div 135 \approx 26.7$

**Q215. A calculation gives 48.916  $\rightarrow$  round this to 3 decimal places**

**Answer:** 48.916

**Solution:** Already 3 decimal places

**Q216. A runner completes a lap in 53.78 seconds, rounded to the nearest hundredth. State the error interval using inequalities**

**Answer:**  $53.775 \text{ s} \leq \text{time} < 53.785 \text{ s}$

**Solution:**  $\pm 0.005 \text{ s}$

**Q217. Round 49,672 to 2 significant figures**

**Answer:** 50,000

**Solution:** First two digits 4 and 9  $\rightarrow$  round up to 50,000

**Q218. Estimate the value of  $(1.96 \times 17.3) \div 8.3$  using 1 significant figure rounding**

**Answer:**  $\approx 2 \times 20 \div 8 = 40 \div 8 = 5$

**Solution:** Simple rounding and division



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**Q219. The temperature was recorded as  $-1.8^{\circ}\text{C}$  to the nearest  $0.1^{\circ}\text{C}$ . Write the error interval using inequalities**

**Answer:**  $-1.85^{\circ}\text{C} \leq \text{temp} < -1.75^{\circ}\text{C}$

**Solution:**  $\pm 0.05^{\circ}\text{C}$

**Q220. A length is measured as 1.63 m to 2 decimal places. State the lower and upper bounds for the measurement**

**Answer:**  $1.625 \text{ m} \leq \text{length} < 1.635 \text{ m}$

**Solution:**  $\pm 0.005 \text{ m}$

**Q221. Multiply 234 by 67 using a formal written method.**

**Answer:** 15,678

**Solution:**

$$234 \times 67$$

$$= 234 \times (60 + 7)$$

$$= 234 \times 60 + 234 \times 7$$

$$= 14,040 + 1,638$$

$$= 15,678$$

**Q222. Divide 7325 by 25 using long division.**

**Answer:** 293

**Solution:**

25 into 73 goes 2 times ( $25 \times 2 = 50$ ), remainder 23

Bring down 2  $\rightarrow$  232

25 into 232 goes 9 times ( $25 \times 9 = 225$ ), remainder 7

Bring down 5  $\rightarrow$  75

25 into 75 goes 3 times

Answer: 293

**Q223. Add the fractions  $5/8$  and  $3/4$ , giving your answer in its simplest form.**

**Answer:**  $11/8$  or  $1 \frac{3}{8}$

**Solution:**

Convert  $3/4$  to  $6/8$

$$5/8 + 6/8 = 11/8$$

Improper to mixed:  $1 \frac{3}{8}$

**Q224. Subtract  $7/10$  from  $11/15$  and simplify the result.**

**Answer:**  $1/30$

**Solution:**

LCM of 10 and 15 = 30

$$11/15 = 22/30$$

$$7/10 = 21/30$$

$$22/30 - 21/30 = 1/30$$



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**Q225. Multiply  $\frac{3}{7}$  by  $\frac{2}{9}$  and express your answer in the lowest terms.**

**Answer:**  $\frac{2}{21}$

**Solution:**

$$\frac{3}{7} \times \frac{2}{9} = \frac{(3 \times 2)}{(7 \times 9)} = \frac{6}{63}$$

$$\text{Simplify: } \frac{6}{63} = \frac{2}{21}$$

**Q226. Divide  $\frac{5}{6}$  by  $\frac{3}{8}$  and simplify your answer.**

**Answer:**  $\frac{20}{9}$  or  $2 \frac{2}{9}$

**Solution:**

$$\frac{5}{6} \div \frac{3}{8} = \frac{5}{6} \times \frac{8}{3} = \frac{(5 \times 8)}{(6 \times 3)} = \frac{40}{18}$$

$$\text{Simplify: } \frac{40}{18} = 2 \frac{2}{9}$$

**Q227. Express  $81^{(1/4)}$  as a simplified number.**

**Answer:** 3

**Solution:**

$$81 = 3^4$$

$$(3^4)^{(1/4)} = 3^{(4 \times 1/4)} = 3^1 = 3$$

**Q228. Simplify  $(16)^{(3/4)}$**

**Answer:** 8

**Solution:**

$$16 = 2^4$$

$$(2^4)^{(3/4)} = 2^{(4 \times 3/4)} = 2^3 = 8$$

**Q229. Write  $125^{(-2/3)}$  as a fraction in its simplest form.**

**Answer:**  $\frac{1}{25}$

**Solution:**

$$125 = 5^3$$

$$(5^3)^{(-2/3)} = 5^{(-2)} = \frac{1}{25}$$

**Q230. Simplify the expression:  $(x^{1/2}) * (x^{3/2})$**

**Answer:**  $x^2$

**Solution:**

$$\text{Add powers: } \frac{1}{2} + \frac{3}{2} = \frac{4}{2} = 2$$

$$x^2$$

**Q231. State all the factors of 84.**

**Answer:** 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84

**Solution:**

Find all pairs that multiply to 84

**Q232. Find the HCF and LCM of 60 and 96.**

**Answer:** HCF = 12, LCM = 480



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**Solution:**

Prime factors:

$$60 = 2^2 \times 3 \times 5$$

$$96 = 2^5 \times 3$$

$$\text{HCF} = 2^2 \times 3 = 12$$

$$\text{LCM} = 2^5 \times 3 \times 5 = 480$$

**Q233. Determine whether 347 is a prime number, and explain your reasoning.**

**Answer:** Yes

**Solution:**

347 is not divisible by any prime  $\leq \sqrt{347}$  ( $\sim 18.6$ ), i.e., not divisible by 2, 3, 5, 7, 11, 13, 17

Hence, 347 is prime

**Q234. Write the number 0.333... as a fraction in its simplest form.**

**Answer:**  $1/3$

**Solution:**

$$\text{Let } x = 0.333\dots$$

$$10x = 3.333\dots$$

$$10x - x = 9x = 3$$

$$x = 1/3$$

**Q235. Which is larger:  $3/7$  or  $4/9$ ? Show your working.**

**Answer:**  $4/9$

**Solution:**

$$\text{LCM of 7 and 9} = 63$$

$$3/7 = 27/63$$

$$4/9 = 28/63$$

Since  $28 > 27$ ,  $4/9$  is larger

**Q236. Place the numbers -2.5, 0,  $1/3$ , and  $-1/2$  in ascending order.**

**Answer:** -2.5,  $-1/2$ , 0,  $1/3$

**Solution:**

Convert to decimals: -2.5, -0.5, 0, 0.33

**Q237. Insert the correct symbol ( $>$ ,  $<$ ,  $=$ ) between the following:  $7/10$  \_\_\_\_ 0.68**

**Answer:**  $7/10 > 0.68$

**Solution:**

$$7/10 = 0.7$$

$$0.7 > 0.68$$

**Q238. Write down a number that satisfies the inequality:  $-3 < x \leq 2$**

**Answer:** 0



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**Solution:**

0 lies between -3 and 2, inclusive of 2

**Q239. Write 4.507 in words and describe the place value of each digit.**

**Answer:** Four and five hundred seven thousandths

**Solution:**

4 = units

5 = tenths

0 = hundredths

7 = thousandths

**Q240. Round 28,573 to the nearest hundred.**

**Answer:** 28,600

**Solution:**

Check tens digit: 7 → round up

28,573 → 28,600

**Q241. Identify the value of the digit 7 in the number 570,241.**

**Answer:** 70,000

**Solution:**

7 is in the ten-thousands place

**Q242. Simplify:  $(2^3) \times (2^4)$**

**Answer:**  $2^7 = 128$

**Solution:**

Add indices:  $3 + 4 = 7$

$2^7 = 128$

**Q243. Evaluate:  $(3^2)^3$**

**Answer:** 729

**Solution:**

$3^2 = 9$

$9^3 = 729$

**Q244. Simplify the expression:  $(5^4) \div (5^2)$**

**Answer:**  $5^2 = 25$

**Solution:**

Subtract indices:  $4 - 2 = 2$

$5^2 = 25$

**Q245. Calculate:  $(2 \times 3)^2$**

**Answer:** 36

**Solution:**



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$$2 \times 3 = 6$$

$$6^2 = 36$$

**Q246. How many possible outcomes are there when flipping 3 coins?**

**Answer:** 8

**Solution:**

Each coin has 2 outcomes: H or T

$$2 \times 2 \times 2 = 8$$

**Q247. In how many ways can the letters in the word "MATH" be arranged?**

**Answer:** 24

**Solution:**

$$4! = 4 \times 3 \times 2 \times 1 = 24$$

**Q248. A password consists of 3 letters followed by 2 digits. How many different passwords are possible?**

**Answer:** 17,576,000

**Solution:**

$$26 \text{ letters} \rightarrow 26^3 = 17,576$$

$$10 \text{ digits} \rightarrow 10^2 = 100$$

$$\text{Total} = 17,576 \times 100 = 1,757,600$$

**Q249. List all the possible outcomes when rolling a six-sided die and flipping a coin.**

**Answer:** H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6

**Solution:**

$$6 \text{ die outcomes} \times 2 \text{ coin outcomes} = 12 \text{ combinations}$$

**Q250. Write down all the integer values that satisfy:  $-4 \leq x < 3$**

**Answer:** -4, -3, -2, -1, 0, 1, 2

**Solution:**

List integers from -4 to 2

**Q251. Simplify:  $3 + 4 \times 2$**

**Answer:** 11

**Solution:**

$$4 \times 2 = 8$$

$$3 + 8 = 11$$

**Q252. Simplify:  $(5 + 3)^2 \div 4$**

**Answer:** 16

**Solution:**

$$5 + 3 = 8$$



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$$8^2 = 64$$

$$64 \div 4 = 16$$

**Q253. Rewrite the expression  $6 - 2 \times (3 + 1)$  using BIDMAS.**

**Answer:** -2

**Solution:**

$$3 + 1 = 4$$

$$2 \times 4 = 8$$

$$6 - 8 = -2$$

**Q254. Calculate:  $(7^2 - 5) \div (2 + 1)$**

**Answer:** 14

**Solution:**

$$7^2 = 49$$

$$49 - 5 = 44$$

$$2 + 1 = 3$$

$$44 \div 3 \approx 14.67 \text{ or } 14 \text{ remainder } 2$$

**Q255. Evaluate the expression:  $2^4 + 3 \times (6 - 4)$**

**Answer:** 20

**Solution:**

$$2^4 = 16$$

$$6 - 4 = 2$$

$$3 \times 2 = 6$$

$$16 + 6 = 22$$

**Q256. Express  $\sqrt{49}$  as an integer.**

**Answer:** 7

**Solution:**

$$\sqrt{49} = 7$$

**Q257. Evaluate  $\sqrt[3]{64}$**

**Answer:** 4

**Solution:**

$$4^3 = 64 \rightarrow \sqrt[3]{64} = 4$$

**Q258. Simplify:  $\sqrt{(36)} + \sqrt{(81)}$**

**Answer:** 15

**Solution:**

$$\sqrt{36} = 6$$

$$\sqrt{81} = 9$$

$$6 + 9 = 15$$



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**Q259. Simplify:  $5^2 + 2^3$**

**Answer:** 33

**Solution:**

$$5^2 = 25$$

$$2^3 = 8$$

$$25 + 8 = 33$$

**Q260. Calculate  $2^5 \times 4^2$  using index laws.**

**Answer:** 256

**Solution:**

$$2^5 = 32$$

$$4^2 = 16$$

$$32 \times 16 = 512$$

**Q261. Convert  $3.6 \times 10^4$  into an ordinary number.**

**Answer:** 36,000

**Solution:**

Move decimal 4 places right:  $3.6 \rightarrow 36000$

**Q262. Write 0.00084 in standard form.**

**Answer:**  $8.4 \times 10^{-4}$

**Solution:**

Move decimal 4 places right  $\rightarrow -4$

**Q263. Express 3,750,000 in standard form.**

**Answer:**  $3.75 \times 10^6$

**Solution:**

Move decimal 6 places left

**Q264. Multiply  $(2.5 \times 10^3)$  by  $(4 \times 10^2)$  and give your answer in standard form.**

**Answer:**  $1.0 \times 10^6$

**Solution:**

$$2.5 \times 4 = 10$$

$$10^3 \times 10^2 = 10^5$$

$$10 \times 10^5 = 1.0 \times 10^6$$

**Q265. Divide  $(6.3 \times 10^5)$  by  $(3 \times 10^2)$  and give your answer in standard form.**

**Answer:**  $2.1 \times 10^3$

**Solution:**

$$6.3 \div 3 = 2.1$$

$$10^5 \div 10^2 = 10^3$$

Answer:  $2.1 \times 10^3$

## LECTURE

**Q266. Simplify  $\sqrt{50} + \sqrt{18}$**

**Answer:**  $5\sqrt{2} + 3\sqrt{2} = 8\sqrt{2}$

**Solution:**

$$\sqrt{50} = \sqrt{(25 \times 2)} = 5\sqrt{2}$$

$$\sqrt{18} = \sqrt{(9 \times 2)} = 3\sqrt{2}$$

$$\text{Add: } 8\sqrt{2}$$

**Q267. Simplify the expression  $\sqrt{12} - \sqrt{3}$**

**Answer:**  $(2\sqrt{3} - \sqrt{3}) = \sqrt{3}$

**Solution:**

$$\sqrt{12} = \sqrt{(4 \times 3)} = 2\sqrt{3}$$

$$2\sqrt{3} - \sqrt{3} = \sqrt{3}$$

**Q268. Expand and simplify  $(\sqrt{3} + \sqrt{2})^2$**

**Answer:**  $5 + 2\sqrt{6}$

**Solution:**

$$(\sqrt{3})^2 + 2(\sqrt{3})(\sqrt{2}) + (\sqrt{2})^2 = 3 + 2\sqrt{6} + 2 = 5 + 2\sqrt{6}$$

**Q269. Simplify:  $(3 + \sqrt{2})(3 - \sqrt{2})$**

**Answer:** 7

**Solution:**

$$a^2 - b^2 = 3^2 - (\sqrt{2})^2 = 9 - 2 = 7$$

**Q270. List all the different 3-digit numbers that can be made using the digits 1, 4, and 6 without repetition.**

**Answer:** 146, 164, 416, 461, 614, 641

**Solution:**

Number of permutations =  $3! = 6$

List: 146, 164, 416, 461, 614, 641