



8 ESSENTIAL QUESTIONS TO MASTER

APPROXIMATION & ESTIMATION

1	Estimate the value of $\frac{6 \cdot 25 \times \pi}{\sqrt[3]{32}}$, giving your answer correct to 1 significant figure.	[2]
2	(a) Calculate $\frac{15.2^2 - 5}{\sqrt{4.1 + 2}}$. Write down the first 5 digits on your calculator display. (b) Write your answer to part (a) correct to 3 decimal places.	[1] [1]
3	By rounding off each number to 2 significant figures, estimate the value of $64789 \div 8.47$. You must show your working clearly.	[2]
4	(a) Round off 4567.892 to (i) 1 decimal place, (ii) 3 significant figures. (b) Round off 0.007654321 to 4 significant figures. (c) Without the use of calculator, estimate the value of (i) $\frac{\sqrt[3]{729}}{10.2} \times 4.95$ (ii) $\frac{\sqrt{50}}{\sqrt[3]{8}} \times 18.2$	[1] [1] [1] [1] [1]
5	Calculate $\frac{(-15)^2 - \sqrt[3]{4.5}}{7.5 + (3.5)^3}$ (a) Write down the first six digits on the calculator display of your answer. (b) Write down your answer to part (a) correct to 4 significant figures.	[1] [1]
6	The diameter of a planet at the equator is 4560 kilometers. This value has been rounded to 3 significant figures. Find the largest and the smallest possible value of the diameter of the planet.	[2]
7	(a) By rounding the numbers to 1 significant figure, estimate the value of $\frac{\sqrt{105.9} \times 67.814}{(2.12)^3}$. Show your working clearly. (b) Without using the calculator, determine whether the value found in (a) is an over or under estimation. Give a reason for your answer.	[2] [1]
8	(a) Express the following numbers correct to 2 significant figures. (i) 0.007183 (ii) 2381	[1] [1]



	(b) In 2022, there were approximately 456,700 movie downloads. This value has been rounded to 4 significant figures. (i) Write down the greatest possible number of movie downloads. (ii) Write down the least possible number of movie downloads.	[1] [1]
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Answer Key:

1	Estimate the square root of 40 as 6.32 since $\sqrt{36} = 6$ & $\sqrt{49} = 7$ Estimate $\sqrt[3]{27}$ as 3.17 since $\sqrt[3]{27} = 3$ and $\sqrt[3]{64} = 4$ $6.25 \times 6.32 \approx 39.5$ $\frac{39.5}{3.17} \approx 12.5$ (10 – correct to 1 sig. fig)	
2	(a) $\frac{15.2^2 - 5}{\sqrt{4.1} + 2}$ $15.2^2 - 5 = 231.04 - 5 = 226.04$ $\sqrt{4.1} + 2 \approx 2.0248457 + 2 = 4.0248457$ $\frac{226.04}{4.0248457} \approx 56.155$ The first 5 digits on the calculator display are (56.155). (b) $56.155 \approx 56.155$	
3	$64789 \approx 65000$ (2 sig fig) $8.47 \approx 8.5$ (2 sig fig) $\frac{65000}{8.5}$ $\frac{65000}{8.5} \approx 7647.0588$ To round off the final result: $7647.0588 \approx 7600$	
4	(a) Round off 4567.892 to (i) $4567.892 \approx 4567.9$ (ii) $4567.892 \approx 4570$ (b) $0.007654321 \approx 0.007654$	



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	(c) Without the use of calculator, estimate the value of For (i), estimate $\sqrt[3]{729}$, which is 9, and $9 \approx 10$. Then calculate $\frac{10}{10.2} \times 4.95 \approx 0.98 \times 4.95 \approx 4.85$. For (ii), estimate $\sqrt{\{50\}} \approx 7$ and $\sqrt[3]{8} = 2$. Then calculate $\frac{7}{2} \times 18.2 \approx 3.5 \times 18.2 \approx 63.7$.	
5	$(-15)^2 = 225$ $\sqrt[3]{4.5} \approx 1.65$ $225 - 1.65 \approx 223.35$ $(3.5)^3 = 42.875$ $7.5 + 42.875 = 50.375$ $\frac{223.35}{50.375} \approx 4.43347$ (a) The first six digits on the calculator display are 4.43347. (b) The answer correct to 4 significant figures is 4.433.	
6	The given diameter is 4560 km, rounded to 3 significant figures. The smallest number that rounds to 4560 when rounded to 3 significant figures is 4550.5 km. The largest number that rounds to 4560 when rounded to 3 significant figures is 4564.5 km. Therefore, the smallest possible value is 4550.5 km and the largest possible value is 4564.5 km.	
7	Round each number to 1 significant figure: $105.9 \approx 100$. $67.814 \approx 70$. $2.12 \approx 2$ Substitute the rounded numbers into this expression: $\frac{\sqrt{100 \times 70}}{2^3}$ $\sqrt{100} = 10$ $10 \times 70 = 700$ $2^3 = 8$ $\frac{700}{8} = 87.5$ Determine overestimate or underestimate: • Square root and division rounding: Since $\sqrt{105.9} < 10$ and $(2.12)^3 > 8$, both contribute to the actual denominator being larger and the numerator being smaller than estimated. • Multiplication rounding: Since $67.814 < 70$, the multiplication step in the numerator is slightly overestimated. • The rounding makes the numerator larger and the denominator smaller than they actually are, leading to an overestimate.	
8	• The first two significant figures are 7 and 1. • The next digit is 8, which is greater than or equal to 5, so we round up. Answer (a)(i) 0.0072	

- The first two significant figures are 2 and 3.
- The next digit is 8, which is greater than or equal to 5, so we round up. Since we're rounding a number greater than 100, we need to replace the remaining digits with zeroes to maintain the magnitude of the number.

Answer (a)(ii) 2400

- Since the number is rounded to 4 significant figures, the maximum possible value occurs just before the number would round up to 456,800.
- The greatest possible number is 456,749.

Answer (b)(i) 456749

- The least possible value occurs just before the number would round down to 456,600.
- The least possible number is 456,650.

Answer (b)(ii) 456650