<u>Stt i Ma</u>	th: Approximatio	<u>n / Estimation</u>	I) Substitution Problems (Advanced)
-		F) Estimation	Given that $\sqrt{3.27}=1.808$ and $\sqrt{32.7}=5.718$, without using a calculator,
A) Rounding off to required decimal place (d.p.) (Basic)		Estimation is a way to get a rough value of a calculation quickly without using a	evaluate
Round off 8.3796 to		calculator.	a) $\sqrt{0.327}$
a) 1 decimal place		If you see the word " <u>estimate</u> " in the question, make sure to:	b) √ <u>32700</u>
b) 2 decimal place		1) Round off FIRST	Note: Working and presentation for this question is very important. Wrong
c) 3 decimal place		2) Then do the calculation.	working equals zero marks even if answer is correct.
d) nearest whole number		3) Round off AGAIN at the end to the desired accuracy!	_
2 8 2706 - 84 (1 d n)		Note: "Estimate" questions always involve rounding off TWO times. Once at the	a) $\sqrt{0.327} = \sqrt{\frac{32.7}{100}}$
a) 8.3796 = 8.4 (1 <i>d. p.</i>) b) 8.3796 = 8.38 (2 <i>d. p.</i>)		beginning and once at the end.	
			$=\frac{\sqrt{32.7}}{10}$
		, \ G) Estimation (Without Square/Cube Root) Example (Intermediate)	$=\frac{5.718}{10}$
d) 8.3796 = 8 (nearest whole number)		Estimate the following, giving your answer corrected 1 significant figure:	= 0.5718
B) Significant Figures (S.f.)		a) 34.82 – 19.35	
Rule 1: All non-zero digits are significant		b) 128.1 × 0.2025	b) $\sqrt{32700} = \sqrt{3.27 \times 10000}$
e.g. 51 (2 s.f.), 81.9 (3 s.f.)		c) $\frac{44.73}{15.21}$	$=\sqrt{3.27} \times 10000$
Rule 2: Zero(s) between non-zero digits are significant			$= \sqrt{3.27 \times 100}$ = 1.808 × 100
e.g. 5002 (4 s.f.), 2.034 (4 s.f.)		Note: Round off to 1 digit more than what the question specify first. Since this question asks for an accuracy of 1 s.f., we will first round off the numbers to 2 s.f.	= 180.8
Rule 3: Zero(s) that come before t	he first non-zero digit are not	before calculation.	
significant			J) Reverse Approximation Problems (Advanced)
e.g. 0.0062 (2 s.f.), 0.0103 (3 s.f.)		a) $34.82 - 19.35 \approx 35 - 19$ (Round to 2 s.f.)	If an integer is 5000 when it is rounded off to 2 significant figures, find the
Rule 4: Zero(s) following a non-zero digit after the decimal point are		= 16	difference between the maximum and minimum possible values of the intege
significant e.g. 0.200 (3 s.f.), 82.30 (4 s.f.)		= 20 (1 s. f.)	
Rule 5: Zero(s) following a non-zero digit in a whole number may or		b) $128.1 \times 0.2025 \approx 130 \times 0.20$	The maximum possible value of the integer $= 5049$
may not be significant		= 26	The minimum possible value of the integer $= 4950$
e.g. 6300 (2s.f, 3s.f. or 4 s.f.), 500 (1 s.f., 2 s.f. or 3 s.f.)		= 30 (1 s. f.)	The maximum difference $= 5049 - 4950$
		c) $\frac{44.73}{15.21} \approx \frac{45}{15}$	= 99
	D) Rounding off to	= 3 (1 s. f.)	U) Devenes Ampleoving the Duckleyes (Advenced)
L) Identify number of S.F. (Basic)	D) Rounding off to Required S.F. (Basic)	= 3 (1 s. f.)	K) Reverse Approximation Problems (Advanced)
Basic)		= 3 (1 s. f.) H) Estimation (With Square/Cube Root) Example (Intermediate)	a) The area of a rectangle is $74.5 cm^2$ when corrected to one decimal place a
Basic) State the number of significant	Required S.F. (Basic)		a) The area of a rectangle is 74. $5cm^2$ when corrected to one decimal place a its breadth is 9. $84cm$ when corrected to two decimal places. Find the greate
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Basic) State the number of significant igures in each of the following: 1) 2339 0) 0.00280 2) 3400 4) 210.0 2) 20.05 1) 2339 has 4 s.f. 2) 300 has 2 or 3 or 4 s.f. 2) 3400 has 2 or 3 or 4 s.f. 2) 3400 has 4 s.f. 2) 20.05 has 4 s.f. 2) 20.05 has 4 s.f.	Required S.F. (Basic) Round off each of the following to the number of significant figures as stated in the brackets. a) 4586 (3 s.f.) b) 0.05758 (2 s.f.) c) 3.401 (3 s.f.) d) 234015 (2 s.f.) e) 39.95 (3 s.f.) a) 4586 = 4590 (3 s.f.) b) 0.05758 = 0.058 (2 s.f.) c) 3.401 = 3.40 (3 s.f.) d) 234015 = 230000 (2 s.f.) e) 39.95 = 40.0 (3 s.f.) Basic)	H) Estimation (With Square/Cube Root) Example (Intermediate) Estimate the following, giving your answer corrected 1 significant figure: a) $\frac{\sqrt{35.4 \times \sqrt[3]{121}}}{\sqrt{4.51}}$ b) $\frac{\sqrt{98-2.027^2}}{\sqrt[3]{26}}$ Note: Values in square or cube roots, we will round the values off to the nearest perfect square and perfect cube respectively. a) $\frac{\sqrt{35.4 \times \sqrt[3]{121}}}{\sqrt{4.51}} \approx \frac{\sqrt{36 \times \sqrt[3]{125}}}{\sqrt[3]{4}}$ $= \frac{6 \times 5}{2}$ = 15 = 20 (1 s. f.) b) $\frac{\sqrt{98-2.027^2}}{\sqrt[3]{26}} \approx \frac{\sqrt{100-2^2}}{\sqrt[3]{27}}$ $= \frac{10-4}{3}$ $= \frac{10-4}{3}$	a) The area of a rectangle is 74. $5cm^2$ when corrected to one decimal place a its breadth is 9. $84cm$ when corrected to two decimal places. Find the greate possible length of the rectangle, corrected to one decimal place. b) A solid cylindrical block of wood has a radius of 28cm and a height of 60cm Both values are measured to the nearest cm. Find the smallest possible volum of the wood correct to the nearest whole number. (Volume of cylinder = $\pi r^2 h$) a) Greatest possible length of a rectangle = $\frac{Greatest possible area}{Smallest possible breadth}$ = $\frac{74.54999}{9.835}$ $\approx 7.580 cm$ = 7.6 cm (1 d. p.) b) Smallest possible volume of wood
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Basic) State the number of significant igures in each of the following: a) 2339 b) 0.00280 c) 3400 d) 210.0 e) 2339 has 4 s.f. b) 0.00280 has 3 s.f. c) 3400 has 2 or 3 or 4 s.f. d) 210.0 has 4 s.f. e) 20.05 has 4 s.f. c) 3400 has 2 or 3 or 4 s.f. d) 210.0 has 4 s.f. e) 20.05 has 4 s.f.	Required S.F. (Basic) Round off each of the following to the number of significant figures as stated in the brackets. a) 4586 (3 s.f.) b) 0.05758 (2 s.f.) c) 3.401 (3 s.f.) d) 234015 (2 s.f.) e) 39.95 (3 s.f.) a) 4586 = 4590 (3 s.f.) b) 0.05758 = 0.058 (2 s.f.) c) 3.401 = 3.40 (3 s.f.) d) 234015 = 230000 (2 s.f.) e) 39.95 = 40.0 (3 s.f.)	H) Estimation (With Square/Cube Root) Example (Intermediate) Estimate the following, giving your answer corrected 1 significant figure: a) $\frac{\sqrt{35.4 \times \sqrt[3]{121}}}{\sqrt{4.51}}$ b) $\frac{\sqrt{98-2.027^2}}{\sqrt[3]{26}}$ Note: Values in square or cube roots, we will round the values off to the nearest perfect square and perfect cube respectively. a) $\frac{\sqrt{35.4 \times \sqrt[3]{121}}}{\sqrt{4.51}} \approx \frac{\sqrt{36 \times \sqrt[3]{125}}}{\sqrt[3]{4}}$ $= \frac{6 \times 5}{2}$ = 15 = 20 (1 s. f.) b) $\frac{\sqrt{98-2.027^2}}{\sqrt[3]{26}} \approx \frac{\sqrt{100-2^2}}{\sqrt[3]{27}}$ $= \frac{10-4}{3}$ $= \frac{10-4}{3}$	a) The area of a rectangle is 74.5 cm^2 when corrected to one decimal place and its breadth is 9.84 cm when corrected to two decimal places. Find the greater possible length of the rectangle, corrected to one decimal place. b) A solid cylindrical block of wood has a radius of 28 cm and a height of 60 cm. Both values are measured to the nearest cm. Find the smallest possible volum of the wood correct to the nearest whole number. (Volume of cylinder = $\pi r^2 h$) a) Greatest possible length of a rectangle = $\frac{Greatest possible area}{Smallest possible breadth}$ = $\frac{74.54999}{9.835}$ $\approx 7.580 cm$ = $7.6 cm (1 d. p.)$ b) Smallest possible volume of wood

Self Practice

1) Rounding off to required decimal place (d.p.) (Basic)	6) Estimation (With Square/Cube Root) Example (Intermediate)
Round off 8.3796 to	Estimate the following, giving your answer corrected 1 significant figure:
a) 1 decimal place	a) $\frac{\sqrt{35.4} \times \sqrt[3]{121}}{\sqrt{4.51}}$ b) $\frac{\sqrt{98} - 2.027^2}{\sqrt[3]{26}}$
b) 2 decimal place	$\sqrt{98.2}$ $\sqrt{98} = 2027^2$
c) 3 decimal place	b) $\frac{1}{\sqrt{26}}$
d) nearest whole number	
	7) Substitution Problems (Advanced)
2) Identify number of S.F. (Basic)	
State the number of significant figures in each of the following:	Given that $\sqrt{3.27} = 1.808$ and $\sqrt{32.7} = 5.718$, without using a calculator, evaluate
a) 2339	a) $\sqrt{0.327}$
b) 0.00280	b) $\sqrt{32700}$
c) 3400	
d) 210.0	
e) 20.05	2) Remains Ammunimetics Problems (Advanced)
	8) Reverse Approximation Problems (Advanced)
	If an integer is 5000 when it is rounded off to 2 significant figures, find the difference between the maximum
	and minimum possible values of the integer.
3) Rounding off to Required S.F. (Basic)	
Round off each of the following to the number of significant figures as stated in the brackets.	
a) 4586 (3 s.f.)	9) Reverse Approximation Problems (Advanced)
b) 0.05758 (2 s.f.)	a) The area of a rectangle is 74. $5cm^2$ when corrected to one decimal place and its breadth is 9. $84cm$ when
c) 3.401 (3 s.f.)	corrected to two decimal places. Find the greatest possible length of the rectangle, corrected to one decimal
d) 234015 (2 s.f.)	
e) 39.95 (3 s.f.)	place.
	b) A colid sylindrical block of wood has a radius of 29cm and a beight of 60cm. Both values are measured to the
	b) A solid cylindrical block of wood has a radius of 28cm and a height of 60cm. Both values are measured to the
	nearest cm. Find the smallest possible volume of the wood correct to the nearest whole number. (Volume of cylinder = $\pi r^2 h$)
4) Evaluate and Round off (Basic)	(volume of cylinder = $\pi r^2 h$)
Use a calculator, evaluate $\frac{\sqrt[3]{21.6}-0.2033}{7.64-(1.7)^2}$ and correct the answer to 3 s.f.	
$7.64-(1.7)^2$	
5) Estimation (Without Square/Cube Root) Example (Intermediate)	
Estimate the following, giving your answer corrected 1 significant figure:	
a) 34.82 - 19.35	
b) 128.1×0.2025	
$c)\frac{44.73}{15.21}$	
() <u>15.21</u>	