EXAM PAPERS PRACTICE

MARK SCHEME

#	Answer	Explanation
1		(a) Using the formula we can write the percentage error in Jurgen's estimate as $\epsilon = \left\lvert\frac{6432400-6378137}{6378137}\right\rvert \times 100$ (M1) $= 0.8507656...$ $= \boxed{0.851\%}$ A1 (b) (i) As Jurgen has assumed the Earth is spherical we can use the formula for the circumference of a circle to find the circumference of the Earth. Hence $C_{\text{Earth}} = 2\pi r$ (M1) $= 2\pi \times 6432400$ $= 40415961$ $= \boxed{40\,420\,000 \text{ metres}}$ A1 (ii) $= \boxed{4.042 \times 10^7 \text{ metres}}$ A1
2		(a) $\boxed{1.475 \times 10^{-1}}$ (b) $\boxed{0.15}$ (c) Using the percentage error formula $\epsilon = \left\lvert\frac{v_A - v_E}{v_E}\right\rvert \times 100\%$ with $v_E = 0.1475$ and $v_A = 0.15$, we obtain $\epsilon = \left\lvert\frac{0.15-0.1475}{0.1475}\right\rvert \times 100\%$ $\boxed{\approx 1.69\%}$
3		(a) Substituting $\alpha = 30^\circ$, $x = 6$ and $y = 46$ in the expression for z, we get $z = \frac{10\sin 30^\circ}{3(6)+46}$ $\boxed{= 0.078125}$ (b) (i) $\boxed{0.08}$ (ii) $\boxed{0.0781}$ (iii) $\boxed{7.81 \times 10^{-2}}$
4		(a) Substituting $\alpha = 54^\circ$, $\beta = 18^\circ$, $x = 24$ and $y = 18.25$ in the expression for A, we get $A = \sqrt{\frac{\sin 54^\circ - \sin 18^\circ}{24^2 + 2(18.25)}}$ $\boxed{\approx 0.028571}$ (b) (i) $\boxed{0.0286}$ (ii) $\boxed{0.029}$ (c) $\boxed{2.86 \times 10^{-2}}$

5		(a) Substituting $x = 45^\circ$, $a = 18$ and $b = \sqrt{2}$ in the expression for Q, we get $$Q = \frac{(\sin 90^\circ + \sqrt{2})(2\sin 45^\circ - 1)}{18^2 - 4\tan 45^\circ}$$ $$= 0.003125$$ (b) (i) 0.003 (ii) 0.00313 (c) Using the percentage error formula $\epsilon = \left\lvert \frac{v_A - v_E}{v_E} \right\rvert \times 100\%$ with $v_E = 0.003125$ and $v_A = 0.003$, we obtain $$\epsilon = \left\lvert \frac{0.003 - 0.003125}{0.003125} \right\rvert \times 100\%$$ $$= 4\%$$
6		(a) Substituting $S = 529$ in the volume of a hemisphere formula, we get $$V = \sqrt{\frac{4(529)^3}{243\pi}}$$ $$\approx 880.7\ \text{cm}^3$$ (b) $881\ \text{cm}^3$ (c) $8.81 \times 10^2\ \text{cm}^3$
7		(a) (i) If we calculate the mean of the measurements, we get $$\mu = \frac{4.92 + 4.95 + 5.02 + 4.95}{4}$$ $$= 4.96$$ (ii) Using the percentage error formula $\epsilon = \left\lvert \frac{v_A - v_E}{v_E} \right\rvert \times 100\%$ with $v_E = 4.96$ and $v_A = 5$, we obtain $$\epsilon = \left\lvert \frac{5 - 4.96}{4.96} \right\rvert \times 100\%$$ $$= 0.81\%$$ (b) (i) 21 (ii) 2.14×10^1
8		(a) The distance between points A$(40, -100)$ and B$(1, -2)$ is $$\text{AB} = \sqrt{(1-40)^2 + (-2-(-100))^2}$$ $$\approx 105.475$$ $$\approx 105$$ (b) 105.5 (c) 1.055×10^2

9		(a) The area of the rectangle is $$A = (7.6 \times 10^2) \times (1.5 \times 10^3)$$ $$\boxed{= 1.14 \times 10^6 \text{ cm}^2}$$ (b) Using the percentage error formula $\epsilon = \left\lvert \frac{v_A - v_E}{v_E} \right\rvert \times 100\%$ with $v_E = 1\,140\,000$ and $v_A = 1\,200\,000$, we obtain $$\epsilon = \left\lvert \frac{1\,200\,000 - 1\,140\,000}{1\,140\,000} \right\rvert \times 100\%$$ $$\boxed{\approx 5.26\%}$$
10		(a) Using the volume of a cuboid formula $V = l \times w \times h$, we get $$V = 9.6 \times 7.4 \times 5.2$$ $$= 369.408$$ $$\boxed{= 369.41 \text{ cm}^3 \text{ (2 d.p.)}}$$ (b) (i) $\boxed{7.35 \leq w < 7.45}$ (ii) $\boxed{5.15 \leq h < 5.25}$ (c) Using the lower bound for each dimension, and the volume formula, we get $$V = 9.55 \times 7.35 \times 5.15$$ $$= 361.491\ldots$$ $$\boxed{= 361 \text{ cm}^3 \text{ (3 s.f.)}}$$ (d) $\boxed{3.61 \times 10^2}$
11		(a) Substituting $x = 12$, $y = 8$ and $z = 15^\circ$ in the expression for F, we get $$F = \frac{(4\sin 30^\circ - 1)(2\tan 45^\circ + 1)}{12^2 - 8^2}$$ $$\boxed{= 0.0375}$$ (b) (i) $\boxed{0.038}$ (ii) $\boxed{0.04}$ (c) Using the percentage error formula $\epsilon = \left\lvert \frac{v_A - v_E}{v_E} \right\rvert \times 100\%$ with $v_E = 0.0375$ and $v_A = 0.03$, we obtain $$\epsilon = \left\lvert \frac{0.03 - 0.0375}{0.0375} \right\rvert \times 100\%$$ $$\boxed{= 20\%}$$

12		(a) Substituting $a = 0.975$, $b = 4.41$ and $c = 35$ in the expression for r, we get $$r = 2(0.975) - \frac{\sqrt{4.41}}{35}$$ $$= 1.89$$ (b) (i) $a = 1,\ b = 4,\ c = 40$ (ii) Substituting $a = 1$, $b = 4$ and $c = 40$ in the expression for r, we get $$r = 2(1) - \frac{\sqrt{4}}{40}$$ $$= 1.95$$ (c) Using the percentage error formula $\epsilon = \left\vert \frac{v_A - v_E}{v_E} \right\vert \times 100\%$ with $v_E = 1.89$ and $v_A = 1.95$, we obtain $$\epsilon = \left\vert \frac{1.95 - 1.89}{1.89} \right\vert \times 100\%$$ $$\approx 3.17\%$$