5 MUST KNOW QUESTIONS TO *CONQUER*

DIRECT & INVERSE PROPORTIONS

1	The volume of a ball, V cm^3, is directly proportional to the cube of its radius, r. When $r = 7.5. V = 562.5\pi$cm^3 (a) Find the equation connecting V and r. Give the value of k, the constant, in terms of π. (b) Calculate the value of V when $r = 9$, giving your answer in terms of π.	[2] [1]
2	The speed of a bullet, *s*, fired from a gun is inversely proportional to the square root of its mass, *m*. When the mass is 64 g, the speed is 676 m/s. (a) Find an equation connecting *s* and *m*. (b) Find the mass of the bullet if its speed is 520 m/s.	[2] [1]
3	*P* is directly proportional to the square of *r* and $P = 200$ when $r = 5$. (a) Express the *P* in terms of *r*. (b) When *r* is increased by 300%, find the percentage increase in *P*.	[1] [2]
4	(a) y is inversely proportional to the square of x. Given that $y = 8$ for a particular value of x, find the value of y when the value of x is doubled. (b) Given that a is directly proportional to the cube of b, and $a = 24$ for a particular value of b. Find the value of a when this value of b is halved.	[1] [2]
5	Sean wants to travel to Johor Bahru from his house. The following table shows the time (*t* hours) that he will take it he travels at different speeds (*v* km/h). *v* km/h | 80 | 100 | 120 *t* hours | 2.5 | 2 | $1\frac{2}{3}$ (a) Are *v* and *t* in direct or inverse proportion? Show working to support your answer. (b) Find the speed, in km/h, of Sean if he takes 3 hours and 30 minutes to get to Johor Bahru from his house. Express your answer correct to 3 decimal places. (c) If Sean wants to reach Johor Bahru at 2 am, what time should he set off if he plans to drive at 80 km/h?	[2] [1] [2]

Answer Key

1	Solutions: (a) When $r = 7.5. V = 562.5\pi.$ $562.5\pi = k($ $k = \frac{562}{7}$ $k = \frac{4}{3}\pi$ $V = \frac{4}{3}\pi$ (b) $520 = \frac{5408}{\sqrt{m}}$ $m = \left(\frac{5408}{520}\right)^2$ $m = 108.16g$ (b) *When* $r = 9$, $V = \frac{4}{3}\pi(9)^3$ $= \frac{4}{3}\pi(729)$ $= 972\pi\ cm^3$ Ans: (a) $V = \frac{4}{3}\pi r^3$ (b) $972\pi\ cm^3$	
2	Solutions: (a) $s = \frac{k}{\sqrt{m}}$ $k = s\sqrt{m} = 676\sqrt{64} = 5408$ $s = \frac{5408}{\sqrt{m}}$ (b) $520 = \frac{5408}{\sqrt{m}}$ $m = \left(\frac{5408}{520}\right)^2$ $m = 108.16g$ Ans: (a) $s = \frac{5408}{\sqrt{m}}$ (b) $m = 108.16g$	
3	Solutions: (a) $P = 8r^2$ $P = kr^2$ $P = 8r^2$ (b) Percentage increase = 1500% $P_{new} = 8(4r)^2$ $= 16V$ Percentage increase $= \frac{16P - P}{P} \times 100$ $= 1500\%$ Ans: (a) $8r^2$ (b) 1500%	
4	Solutions: (a) $8 = \frac{k}{x^2}$ New $y = \frac{8x^2}{(2x)^2}$ $y = 2$ (b) $\frac{24}{b^3} = \frac{a}{(0.5b)^3}$ $\frac{24}{b^3} = \frac{a}{0.125b^3}$ $a = 3$ Ans: (a) 2 (b) 3	
5	Ans: (a) *v* and *t* are in inverse proportion because the product vt is always a constant. (b) Distance from home to JB $= 200km$ Time taken $= 3.5h$ His speed $= \frac{200}{3.5} = 57.143km/h$ (3d.p) (c) Time taken $= \frac{200}{80} = 2.5h$ He must set off at 11:30PM	