1	(b)	$(-5)^2 - 4 \times -5$ oe e.g. $25 + 20$				2	M	-	
				45			Al		
2	a			9		1	B1		
	b			$f(x) \ge 0$	0	1	B1	accept $y \ge 0$ or $f \ge 0$	
	С	$(g(2) =) \frac{4}{2+3} \left(= \frac{4}{5} \right)$ oe					M1	or for sight of fg(x) e.g. $\left(\frac{4}{x+3}-4\right)^2$	
				10.24	,	2	A1	oe e.g. $\frac{256}{25}$	
								Total 4 ma	rks
3	(0)	1-			3		M1 o	e k can be any letter (must be a letter and not 1	`
	(a) —	$A = \frac{k}{r^2}$						mplies first M1 if you see this stage)
		$5 = \frac{k}{0.3^2}$ oe or $k = 0.45$ oe							
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	A :	$=\frac{0.45}{r^2}$				e with A as the subject eg $A = \frac{9}{20r^2}$	
		oovious incorrect working/						allow $A = \frac{k}{r^2}$ where $k = 0.45$ oe)	,
								SC if M0 scored then award B2 for $A \propto \frac{0.45}{r^2}$ o	e)
	(b)	$[A =] \frac{"0.45"}{(7.5A)^2}$ oe or $\frac{"0.45"}{56.25A^2}$ or			3			from (a) dep on M2 in (a) $[A =] \frac{\text{"0.45"}}{7.5 \text{ A}^2} \text{ is zero marks unless recovered la}$	ter)
		$\frac{9}{20(7.5A)^2}$ oe							
		$A^3 = \frac{0.45}{56.25}$ ($A^3 = \frac{1}{125}$ or 0.008 oe) or						their 0.45 dep on M2 in (a) fust include A^3	
		$125 A^3 = 1$ oe Working not required, so correct		0.2			A1 o	e	
		answer scores full marks (unless from obvious incorrect working)		0.2			711 0		
								Total 6 ma	rks
	()	$5 \times (-2)^2 - (-2)^3 (= 208)$					2	261	
4	(a)	$5 \times (-2)^2 - (-2)^3 (= 208)$					2	M1 for correct expression or at least one of 20 or 5×4 or 8 (+) 8	or
				28				Al	
-	(-)			1	-			1 D1	
5	(a)	<u> </u>			5			1 Bl cao	
6	81	for $\pm 125t^{-2}$ oe				5	M1	for differentiating one term correctly	
	-	$t - 125t^{-2}$ oe or $8t - \frac{125}{t^2}$ oe					A1	for both terms correct	
	81	$t-125t^{-2}=0$ and $(t=)\sqrt[3]{\frac{125}{8}}(=2.5)$						for equating their $8t \pm at^{-2}$ oe or $bt \pm 125t^{-2}$ oe to	
	01	$\sqrt{\frac{123i}{8}} = 0$ and $(i =)\sqrt{\frac{8}{8}} = (-2.3)$						and solving for t ie must have correct powers of at least one correct coefficient and correct isolate	
							of t		1011
	4	$("2.5")^2 + \frac{125}{"2.5"}$					M1	dep on previous M mark for substituting into s	
				75			A1		
								Total 5 ma	rks
7	M =	kh^3 oe or $4 = k \times 0.5^3$ oe				4	M1	$k \neq 1$ and where k M2 for	
								could be any letter $500 h^3$	
	$k = \frac{1}{6}$	$\frac{4}{0.5^3}$ or $k = \frac{4}{0.125}$ or $k = 32$					M1	Allow this for M2 if $M = kh^3$ is not written	oe
		$\sqrt[3]{\frac{500}{32^{\circ}}}$ or $\sqrt[3]{\frac{500 \times 0.5^3}{4}}$ or $\sqrt[3]{15.625}$ or					M1	for a correct expression for h using correct valor a value of k from a completely correct meth	
-	n = 3	5 × 0.5		2.5		1	A1	oe	
								Total 4 ma	rks

fied answer in the form $\frac{m}{n}$ ie implified to remove the fraction
inplified to remove the fraction
Total 3 marks
erms of a and equating two
\tilde{n} answer in the form $\frac{m}{n}$
Total 3 marks
eı

9	$v = \frac{k}{2}$ or $kv = \frac{1}{2}$ or	Alternative		4	M1
	\sqrt{x} \sqrt{x}				Constant of proportionality must
	$y = pT^3$ or $y = \frac{k}{k}$ or				be a symbol such as k or p or c or
	$\sqrt{nT^3}$				n $k \neq 1, p \neq 1$ and $c \neq 1$ and $n \neq 1$
	C V F 2	$v^2T^3 = n$ oe			$k \neq 1, p \neq 1$ and $c \neq 1$ and $n \neq 1$
	$y = \frac{k}{\sqrt{x}} \text{ or } ky = \frac{1}{\sqrt{x}} \text{ or}$ $x = pT^3 \text{ or } y = \frac{k}{\sqrt{pT^3}} \text{ or}$ $y = \frac{c}{\sqrt{T^3}} \text{ oe}$	y = n oe			
	$c = 8 \times \sqrt{25^3} \ (=1000) $ oe	$n = 8^2 \times 25^3 \ (= 1000000) $ oe			M1 dep M1 for rearranging for c or n with $(y =) 8$ and $(T =) 25$
					substituted correctly into their
					equation
	$27 = \frac{1000}{\sqrt{T^3}}$ and $T^3 = \left(\frac{1000}{27}\right)^2$ oe	$T^3 = \frac{1000000}{2}$ oe			M1 for substitution of y and a
	$\sqrt{T^3}$ 27	272			correct rearrangement for T^3 or
	$\sqrt{T^3}$ $\left(\frac{27}{7}\right)^{\frac{1}{3}}$ and $T^2 = \left(\frac{1000}{27}\right)^{\frac{1}{3}}$ oe				T^{2} or T .
			100		Al oe eg 11 or 11.1 or
			9		9 11.111()
					Total 4 marks

eg $40 = \frac{k}{1.5^2}$ or $k = 90$ or $\frac{C^2}{1.5^2} = \frac{40}{1000} (= 0.04)$ or $(C^2 =)1.5^2 \times \frac{40}{1000} (= 0.09)$ or $\frac{1.5^2}{C^2} = \frac{1000}{40} (= 25)$ or $(C^2 =)1.5^2 \div \frac{1000}{40} (= 0.09)$		3	MI
eg $(C =) \sqrt{\frac{190^{11}}{1000}}$ oe or $(C =) \sqrt{\frac{1.5^2 \times 10.04^{11}}{1000}}$ or $(C =) \sqrt{1.5^2 \div 125^{11}}$ or $(C =) \sqrt{10.09^{11}}$	0.3		M1 A1 oe, allow ±0.3 oe or −0.3 oe
			Total 3 marks

11 (a)	-0.5	1	B1 1 -1 1
11 (a)	0.0	-	oe eg $-\frac{1}{2}$, $-\frac{1}{2}$, $-\frac{1}{2}$
			2 2 -2

12 (a)	$P = \frac{k}{y^2}$				3	M1 oe (the constant term, k , can be any other letter apart from a or P or y)
	eg $a = $	$\frac{k}{4^2}$ or $k = 16a$				M1 oe
	Correct working	answer scores full marks (unless from obvious inco ?)	rrect	$P = \frac{16a}{y^2}$		A1 oe eg $P = 16ay^{-2}$ or $P = \frac{4^2 a}{y^2}$
(b)	or (when I	$y = c\sqrt{a}$ oe eg $\frac{16a}{4a} = c^2 a$ or $4a = \frac{16a}{c^2 a}$ or $4a \times c^2 a = c^2 a$ or $4a = \frac{16a}{c^2 a}$ or $4a \times c^2 a = c^2 a$ or $4a = \frac{16a}{4a}$ or $4a \times c^2 a = c^2 a$ or $4a = \frac{16a}{c^2 a}$ or $4a \times c^2 a = c^2 a$	=16 <i>a</i> oe		3	M1 ft a correct formula involving the constant term (c used here) and a or ft for an expression or value of y^2 or y given for when $P = 4a$
		or $c = \frac{\pm 2}{\sqrt{a}}$ or $c = \frac{\pm 2\sqrt{a}}{a}$ oe see constant term squared eg $c^2 = \frac{16a}{4a^2} \left(= \frac{4}{a} \right)$				M1 (implies previous M1) a correct value, in terms of <i>a</i> , for the constant term or the constant term squared – need not be simplified
	Correct working	answer scores full marks (unless from obvious inco 3)	orrect	$P = \frac{4a^2}{x}$		Al oe eg $P = \frac{16a}{\frac{4x}{a}}$ or $P = \frac{16a^2}{4x}$
						Total 6 marks
13	(b)		0.2	25	1	A1ft oe dep on M1 in part (a) and for their value of k if $F = \frac{k}{r^2}$
14	(a)	25 ± or 12 or $(-5)^2 - 4 \times 3$ or $(-5)^2 - 4(3)$ or $-5 \times -5 - 4 \times 3$ or $-5 \times -5 - 4(3)$			2	M1 for either 25 or -12 in the correct place or the correct substitution shown with brackets around -5
		Correct answer scores full marks (unless from obvious incorrect working)	1	3		A1 (M0A0 for -37 without any working)