1	$2x^3 + 9x^2 + 4x - 15$	**3**	as final answer; ignore '= 0'; **B2** for 3 correct terms of answer seen or for an 8-term or 6 term expansion with at most one error: or **M1** for correct quadratic expansion of one pair of brackets; or **SC1** for a quadratic expansion with one error then a good attempt to multiply by the remaining bracket	correct 8-term expansion: $2x^3 + 6x^2 - 2x^2 + 5x^2 - 6x + 15x - 5x - 15$ correct 6-term expansions: $2x^3 + 4x^2 + 5x^2 - 6x + 10x - 15$ $2x^3 + 6x^2 + 3x^2 + 9x - 5x - 15$ $2x^3 + 11x^2 - 2x^2 + 15x - 11x - 15$ for **M1**, need not be simplified; ie **SC1** for knowing what to do and making a reasonable attempt, even if an error at an early stage means more marks not available
2	$b^2 - 4ac$ soi 1 www 2 [distinct real roots]	**M1** **A1** **B1**	 or **B2** **B0** for finding the roots but not saying how many there are	allow seen in formula; need not have numbers substituted but discriminant part must be correct; clearly found as discriminant, or stated as $b^2 - 4ac$, not just seen in formula eg **M1A0** for $\sqrt{b^2 - 4ac} = \sqrt{1} = 1$; condone discriminant not used; ignore incorrect roots found

3	$yx + 3y = 1 - 2x$ oe or ft	**M1**	for multiplying to eliminate denominator <u>and</u> for expanding brackets, or for correct division by y <u>and</u> writing as separate fractions: $x+3=\frac{1}{y}-\frac{2x}{y}$;	each mark is for carrying out the operation correctly; ft earlier errors for equivalent steps if error does not simplify problem; some common errors: $y(x + 3) = 1 - 2x$ $yx + 3x = 1 - 2x$ **M0** $yx + 5x = 1$ **M1** ft $x(y + 5) = 1$ **M1** ft $x=\frac{1}{y+5}$ **M1** ft $yx + 3 = 1 - 2x$ **M0** $yx + 2x = -2$ **M1** ft $x(y + 2) = -2$ **M1** ft $x=\frac{-2}{y+2}$ **M1** ft
	$yx + 2x = 1 - 3y$ oe or ft	**M1**	for collecting terms; dep on having an ax term and an xy term, oe after division by y,	
	$x(y + 2) = 1 - 3y$ oe or ft	**M1**	for taking out x factor; dep on having an ax term and an xy term, oe after division by y,	
	$[x=]\frac{1-3y}{y+2}$ oe or ft as final answer	**M1**	for division with no wrong work after; dep on dividing by a two-term expression; last M not earned for triple-decker fraction as final answer	for **M4**, must be completely correct;

4	$n(n+1)(n+2)$ argument from general consecutive numbers leading to: at least one must be even [exactly] one must be multiple of 3	M1 A1 A1	condone division by n and then $(n+1)(n+2)$ seen, or separate factors shown after factor theorem used; or divisible by 2; if M0: allow **SC1** for showing given expression always even	ignore ‘ = 0’; an induction approach using the factors may also be used eg by those doing paper FP1 as well; **A0** for just substituting numbers for n and stating results; allow **SC2** for a correct induction approach using the original cubic (**SC1** for each of showing even and showing divisible by 3)

5	$5(x+2)^2 - 14$	**4**	**B1** for $a = 5$, <u>and</u> **B1** for $b = 2$ <u>and</u> **B2** for $c = -14$ or **M1** for $c = 6 -$ their ab^2 or **M1** for [their a](6/their a – their b^2) [no ft for $a = 1$]

6	$[a =]2c^2 - b$ www o.e.	**3**	**M1** for each of 3 complete correct steps, ft from previous error if equivalent difficulty

7	$[a =]\dfrac{2(s-ut)}{t^2}$ o.e. as final answer [condone $[a =]\dfrac{(s-ut)}{0.5t^2}$]	3	M1 for each of 3 complete correct steps, ft from previous error if equivalent difficulty [eg dividing by t does not count as step – needs to be by t^2] $[a =]\dfrac{(s-ut)}{\frac{1}{2}t^2}$ gets M2 only (similarly other triple-deckers)	3

8	any general attempt at n being odd <u>and</u> n being even even n odd implies n^3 odd and odd − odd = even n even implies n^3 even and even − even = even	M1 A1 A1	M0 for just trying numbers, even if some odd, some even or $n(n^2 - 1)$ used with n odd implies $n^2 - 1$ even and odd × even = even etc [allow even × odd = even] or A2 for $n(n - 1)(n + 1)$ = product of 3 consecutive integers; at least one even so product even; odd^3 − odd = odd etc is not sufft for A1 SC1 for complete general method for only one of odd or even eg $n = 2m$ leading to $2(4m^3 - m)$	3

9	(i) $x + 3)^2 - 4$ (ii) ft their $(-a, b)$; if error in (i), accept $(-3, -4)$ if evidence of being independently obtained	3 2	B1 for $a = 3$, B2 for $b = -4$ or M1 for $5 - 3^2$ soi B1 each coord.; allow $x = -3$, $y = -4$; or M1 for $\begin{bmatrix}-3\\-4\end{bmatrix}$ o.e. oe for sketch with −3 and −4 marked on axes but no coords given	5
10	$(x^2 - 9)(x^2 + 4)$ $x^2 = 9$ [or −4] or ft for integers /fractions if first M1 earned $x = \pm 3$ cao	M2 M1 A1	or correct use of quad formula or comp sq reaching 9 and −4; allow M1 for attempt with correct eqn at factorising with factors giving two terms correct, or sign error, or attempt at formula or comp sq [no more than two errors in formula/substn]; for this first M2 or M1 allow use of y etc or of x instead of x^2 must have x^2; or M1 for $(x + 3)(x - 3)$; this M1 may be implied by $x = \pm 3$ A0 if extra roots if M0 then allow SC1 for use of factor theorem to obtain both 3 and −3 as roots or $(x + 3)$ and $(x - 3)$ found as factors and SC2 for $x^2 + 4$ found as other factor using factor theorem [ie max SC3]	4

11	1/5 or 0.2 o.e. www	3	M1 for $3x + 1 = 2x \times 4$ and M1 for $5x = 1$ o.e. <u>or</u> M1 for $1.5 + \frac{1}{2x} = 4$ and M1 for $\frac{1}{2x} = 2.5$ o.	3

12	$b^2 - 4ac$ soi $k^2 - 4 \times 2 \times 18 < 0$ o.e. $-12 < k < 12$	M1 M1 A2	allow in quadratic formula or clearly looking for perfect square condone $\le$; or M1 for 12 identified as boundary may be two separate inequalities; A1 for $\le$ used or for one ‘end’ correct if two separate correct inequalities seen, isw for then wrongly combining them into one statement; condone b instead of k; if no working, SC2 for $k < 12$ and SC2 for $k > -12$ (ie SC2 for each ‘end’ correct)	4
13	$y + 5 = xy + 2x$ $y - xy = 2x - 5$ oe or ft $y(1 - x) = 2x - 5$ oe or ft $[y =]\frac{2x-5}{1-x}$ oe or ft as final answer	M1 M1 M1 M1	for expansion for collecting terms for taking out y factor; dep on xy term for division and no wrong work after ft earlier errors for equivalent steps if error does not simplify problem	4