M1.

$(3x + a)(x + b)$
where $ab = 8$ or $a + 3b = 14$
or
$3x(x + 4) + 2(x + 4)$
or
$x(3x + 2) + 4(3x + 2)$

M1

$(3x + 2)(x + 4)$
oe

A1

[2]

M2.

$(3a - b)(3a + b)$

B1 $(3a - b)(3a - b)$ or $(3a + b)(3a + b)$
or $(3a - b)^2$ or $(3a + b)^2$
or $(9a + b)(a - b)$ or $(9a - b)(a + b)$

B2

Additional Guidance
$(3a - b) \times (3a + b)$

B1

[2]

M3.

$a = 4$ or $(3x - 1)(4x + b)$

B1

$3ax^2 + 3bx - ax - b$

or $3b - a = -19$

or $12x^2 + 3bx - 4x - b$

M1

$3bx - 4x = -19x$

or $3b - 4 = -19$

or $3b = -15$ or $b = -5$

or $(3x - 1)(4x - 5)$

This mark implies B1M2

M1

$a = 4$ and $b = -5$ and $c = 5$

A1

Additional Guidance

$3ax^2 + 3bx - 1ax - b$ or $3ax^2 + 3bx - ax - 1b$

M1

Condone $3x^2a$ and $3xb$ and xa

[4]

M4. $(5x - 3)(x + 4)$

B1

$(x - 4)(x + 4)$

B1

$$\frac{5x - 3}{x - 4}$$

Do not allow fw

B1dep

[3]

M5.

(a) $(ax + p)(bx + q)$

where $ab = 3$ *and* $pq = \pm 10$

or $aq + bp = -13$

M1

$(3x + 2)(x - 5)$

A1

(b) $3x(x - 5)$

M1

$\frac{3x}{3x + 2}$

ft their answer to part (a) correctly simplified from common linear factors

A1ft

Additional Guidance

Do not allow further incorrect work

e.g. $\frac{3x}{3x + 2}$ incorrectly simplified to $\frac{1}{2}$

M1A0

[4]

M6.

(a) $3(x + 2)(x - 2)$

B1 for $3(x^2 - 4)$

or $(3x + 6)(x - 2)$

or $(x + 2)(3x - 6)$

B2

(b) $(5x + ay)(x + by)$

where $ab = \pm 12$ *or* $a + 5b = \pm 4$

M1

$(5x \pm 6y)(x \pm 2y)$

for correct y terms in correct brackets, but with a sign error

A1

$(5x - 6y)(x + 2y)$

A1

[5]

M7.

(a) $3d(4c^2 - 3d)$

B1 $d(12c^2 - 9d)$ or $3(4c^2d - 3d^2)$

B2

(b) **Alternative method 1**

$(w + 4)^2$ as a factor

Allow $(w + 4)(w + 4)$

M1

$(w + 4)^2(w + 4 - (w + 1))$
or
$(w + 4)^2(w + 4 - w + 1)$
or
$(w + 4)^2(w + 4 - w - 1)$

Allow $(w + 4)(w + 4)$ for $(w + 4)^2$

M1dep

$3(w + 4)^2$

Allow $3(w + 4)(w + 4)$

A1

Alternative method 2

$(w + 4)[(w + 4)^2 - (w + 4)(w + 1)]$

M1

$(w + 4)(aw + b)$

a and b both non-zero

M1

$3(w + 4)^2$

Allow $3(w + 4)(w + 4)$

A1

Alternative method 3

$w^3 + 12w^2 + 48w + 64$
or
$w^3 + 9w^2 + 24w + 16$
or
$-w^3 - 9w^2 - 24w - 16$
or
$-w^3 + 9w^2 + 24w + 16$
or
$3w^2 + 24w + 48$
or
$3(w^2 + 8w + 16)$

Must collect terms

M1

$(3w + 12)(w + 4)$

Correctly factorises their three term quadratic

M1dep

$3(w + 4)^2$

Accept 3(w + 4) (w + 4)

A1

[5]

M8. $x^2 + ax + ax + (a^2)$

or $x^2 + 2ax + (a^2)$

or $2a = 8$ or $a^2 + b = 7$

M1

$(x + 4)^2$

or $a = 4$ or $b = -9$

A1

$(x + 4)^2 - 9$

*allow $a = 4$ **and** $b = -9$*

A1

[3]

M9. $(x - 4)(x + 4)$

B1

$(2x + 3)(x - 4)$

or $(2x + a)(x + b)$

where $ab = \pm 12$ *or* $2b + a = -5$

M1

$\frac{x + 4}{2x + 3}$

A1

[3]

M10. $(3x - 1)(3x + 1)$

B1

$(3x \pm a)(x \pm b)$

$ab = \pm 1$

M1

$(3x - 1)(x + 1)$

A1

Their $\frac{(3x-1)(3x+1)}{(3x-1)(x-1)} \times \frac{x-2}{3x+1}$

This mark is for turning the second fraction upside down and multiplying by it. It can be awarded for cross multiplying at any stage

eg $(9x^2 - 1)(x - 2) \div (3x^2 + 2x - 1)(3x + 1)$

M1

$\frac{x-2}{x+1}$

Do not accept incorrect further work

ft on $\frac{(3x-1)(3x+1)}{(3x+1)(x-1)} \times \frac{x-2}{(3x+1)}$

$= \frac{(3x-1)(x-2)}{(3x+1)(x-1)}$

A1ft

[5]

M11.

(ax + b)(cx + d)

Where $ac = 4$ and $bd = \pm 5$ or $ad + bc = \pm 19$

M1

(4x − 1)(x + 5)

A1

(3x − 4)(3x + 4)

B1

their $\frac{(4x-1)(x+5)}{(3x-4)(3x+4)} \times \frac{(3x-4)}{(x+5)}$

Inverting the 2nd fraction and multiplying
Must have attempted to factorise both expressions (allow max one error in each)

M1

$\frac{4x-1}{3x-4}$

A1

[5]

M12.

(a) 5(m + 2p)(m − 2p)

B2 (5m + 10p)(m − 2p) or
(5m − 10p)(m + 2p)

B1 $5(m^2 - 4p^2)$ *or*

$(5m + ap)(m + bp)$ *where* $ab = \pm 20$

B3

(b) Their $(m + 2p) = 0$ **or**

Their $(m - 2p) = 0$

oe e.g. $m = -2p$ *or* $m = 2p$

May substitute for p at this stage

M1

−30 **and** 30

A1

Alternative method

$5m^2 - 20 \times 15 \times 15 = 0$

oe e.g. $5m^2 = 4500$

M1

−30 **and** 30

A1

[5]

M13.

$(2x + 3)(2x - 3)$

B1

$(2x \pm a)(x \pm b)$

$ab = \pm 3$

M1

$(2x + 3)(x - 1)$

A1

$\frac{2x - 3}{x - 1}$

ft if B1 and M1 awarded and terms cancelled

Do not award if incorrect further work

A1ft

[4]

M14.

$2(x^2 - 6x)$ .....

M1

$2(x - 3)^2$ .....

M1dep

$2((x - 3)^2 - 9\ (-3.5))$
or
$2(x - 3)_2 - 18\ (-7)$

M1dep

$2(x - 3)^2 - 25$

A1

Alternative method
$x^2 + bx + bx + b^2$

M1

$a = 2$

M1

$-12 = 2ab$ or $-12 = 4b$
and
$-7 = ab^2 + c$ or $-7 = 2b^2 + c$

M1

$2(x - 3)^2 - 25$

A1

[4]