Mark schemes

Q1.

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

B1

[1]

Q2.

(a) $x^2 + 5x - 5x - 25$

Must see full correct expansion

B1

(b) $(3x + p)(x + q)$ where $pq = \pm 20$

M1

$(3x - 4)(x - 5)$ in numerator

A1

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

Do not ignore further working ie max 2 marks if any further working

A1

[4]

Q3.

$\frac{n(n-1)+n(n+1)}{2}$

This mark is for combining fractions or if fractions dealt with separately, for combining n2 terms correctly

$\frac{n^2 - n + n^2 + n}{4}$ *is B0 as incorrect combining of fractions*

B1

$\frac{n^2 - n + n^2 + n}{2} = \frac{2n^2}{2}$

This mark is for eliminating −n and n either by showing by crossing or writing on same line and writing next line without them

$\frac{n^2}{2} - \frac{n}{2} + \frac{n^2}{2} + \frac{n}{2}$

B1

$\frac{2n^2}{2} = n^2$

This mark is for cancelling 2 top and bottom

$\frac{n^2}{2} + \frac{n^2}{2} = n^2$

B1

Alternative Method

$\frac{n}{2}((n-1)+(n+1))$

This mark is for factorising out a common factor.

$\frac{n}{4}(n-1+n+1)$ *is B0 as incorrect factorisation*

B1

$\frac{n}{2}(2n)$

This mark is for combining terms inside bracket correctly

B1

n^2

$1n^2$ *is OK*

B1

[3]

Q4.

$x(x+3)$

M1

$(x+3)(5x-4)$
or $(x+a)(5x+b)$

where $ab = \pm 12$ *or* $5a + b = 11$

M1

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

Do not allow further working

A1

[3]

Q5.

$6(x+3)$ or $(-)2(x-2)$
or $6x + 18$ or $2x - 4$ or $-2x + 4$
or $(x-2)(x+3)$

M1

$6x + 18 - 2x + 4$
or $4x + 22$
or $x2 - 2x + 3x - 6$
or $x2 + x - 6$

allow three correct terms after expansion
ignore RHS and denominator

allow three correct terms after expansion as denominator or

RHS

M1

$x^2 - 3x - 28 = 0$

A1

$(x - 7)(x + 4)\ (= 0)$

correct method to solve their quadratic equation by
correct substitution into the quadratic formula
or correct completion of the square
or correct factorisation

M1

$(x =)\ 7$ and $(x =)\ -4$

SC2 $(x =)\ 7$ or $(x =)\ -4$

A1

Additional Guidance

Correct substitution into quadratic formula

$$x = \frac{--3 \pm \sqrt{(-3)^2 - 4 \times 1 \times -28}}{2 \times 1}$$

[5]

Q6.

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

$ab = \pm 3$

M1

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

Ignore non contradictory further work such as solving the quadratic

A1

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

B1

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

Do not award if incorrect further work.
ft their (a) if common factor cancelled eg (a) = $(2x + 1)(x + 3)$ answer is $\frac{x-1}{2x-3}$

B1ft

[4]

Q7.

$7x + \frac{10x}{x+2} = 9$

or $7(x + 2) + 10 = \frac{9}{x}(x + 2)$

or $7 + \frac{10x}{x+2} - \frac{9}{x} = 0$

M1 for equating two correct fractions

$\frac{7(x+2)+10}{x+2} = \frac{9}{x}$ or $\frac{10}{x+2} = \frac{9-7x}{x}$

Also M1 for $7 + \frac{10x}{x(x+2)} = \frac{9(x+2)}{x(x+2)}$

M1

$7x(x + 2) + 10x = 9(x + 2)$

oe

M1 dep

$7x2 + 14x + 10x = 9x + 18$

or $7x2 + 14x + 10x - 9x - 18 = 0$

A1

[3]

Q8.

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

B1

$(x + 5)(x - 5)$

B1

$x(x - 5)$

B1

$\frac{\text{their } (x+6)(x-2)}{\text{their}(x+5)(x-5)} \times \frac{\text{their } x(x-5)}{x+6}$

Must have attempted to factorise at least two of the above

M1

$\frac{x(x-2)}{x+5}$ or $\frac{x^2-2x}{x+5}$

A0 if incorrect further work seen

A1

[5]

Q9.

(a) $\frac{4c^5}{9d^3}$ or $\frac{4c^5d^{-3}}{9}$ or

$\frac{0.4c^5}{d^3}$ or $0.4c^5d^{-3}$

B2 Any two of these three components

- *numerator having c5 (no c in denominator)*
- *denominator having d3 (no d in numerator)*
  or numerator having d−3 (no d in denominator)
- *number* $\frac{4}{9}$ *or 0.4*

B1 Any one of these three components

- *numerator having c5 (no c in denominator)*
- *denominator having d3 (no d in numerator)*
  or numerator having d−3 (no d in denominator)
- *number* $\frac{4}{9}$ *or 0.4*

or

$\frac{40c^7d^3}{90d^6c^2}$ or $\frac{20c^7d^3}{45d^6c^2}$ or $\frac{8c^7d^3}{18d^6c^2}$

or $\frac{1.3c^7d^3}{3d^6c^2}$ or $\frac{\frac{4}{3}c^7d^3}{3d^6c^2}$

SC1 $\frac{9d^3}{4c^5}$ or $\frac{2.25d^3}{c^5}$

Always award SC1 if this is their final answer even if $\frac{4c^5}{9d^3}$ *seen in working*

B3

(b) $(m + 1)(m – 4)$ or $m^2 – 3m – 4$ seen as a common denominator

oe

B1

$5(m – 4) + 6(m + 1)$

Allow one error in expansion if not showing brackets

e.g. Allow 5m – 20 + m + 6

M1

$\frac{5m – 20 + 6m + 6}{\text{their common denominator}}$

or

$\frac{5m – 20}{\text{their common denominator}} + \frac{6m + 6}{\text{their common denominator}}$

Allow one error in expansion of numerator(s)

their common denominator must be a quadratic

M1

$\frac{11m – 14}{(m + 1)(m – 4)}$ or $\frac{11m – 14}{m^2 – 3m – 4}$

A1

[7]

Q10.

(a) $\frac{4(x-1)+2x}{x(x-1)}$

oe e.g. two separate fractions
Condone absence of brackets only if recovered

M1

$\frac{4(x-1)+2x}{x(x-1)}$ $\left(=\frac{6x-4}{x(x-1)}\right)$

Do not condone absence of brackets even if recovered

A1

(b) $6x - 4 = 3x(x - 1)$

oe e.g. $4(x- 1) + 2x = 3x (x - 1)$

M1

$3x^2 - 9x + 4 (= 0)$

$-3x^2 + 9x - 4 (= 0)$

A1

$\frac{--9 \pm \sqrt{(-9)^2 - 4 \times 3 \times 4}}{2 \times 3}$

$\left(\frac{9 \pm \sqrt{33}}{6}\right)$

Correct use of formula for their quadratic
M1 Allow one sign error (must have square root and numerator all over 2a)
Allow M2 for correct factorisation of their quadratic

M2 $(x-\frac{3}{2})^2 = \frac{9}{4} - \frac{4}{3}$ *oe*

M1 $(x-\frac{3}{2})^2 = \frac{9}{4} + \frac{4}{3} = 0$ *oe*

M2

2.46 and 0.543

Must both be to 3 significant figures

A1

[7]

Q11.

(a) $5x^2 + 10xy - 2xy - 4y^2$

Allow one error in their four terms

M1

$5x^2 + 10xy - 2xy - 4y^2$

Fully correct
May be in a grid

A1

$5x^2 + 8xy - 4y^2$

ft their four terms
Do not ignore fw

A1ft

Alternative method 1

(b) $\frac{2 \pm \sqrt{(-2)^2 - (4 \times 1 \times -2)}}{2}$

oe
Allow one error

M1

$\frac{2 \pm \sqrt{(-2)^2 - (4 \times 1 \times -2)}}{2}$

or $\frac{2 \pm \sqrt{4 - -8}}{2}$

oe
Fully correct

A1

2.7 and − 0.7

SC2 for either 2.7 or − 0.7

A1

Alternative method 2

$(x - 1)2 - 1 - 2 = 0$

oe

M1

$1 \pm \sqrt{3}$

oe
Fully correct
or 2.7(...) or − 0.7(...)

A1

2.7 and − 0.7

SC2 for either 2.7 or − 0.7

A1

Additional Guidance

− 0.73(...) or 2.73(...)

M1A1A0

− 22 in the discriminant is one error unless recovered

(c) $(ax+b)(cx+d)$

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

where $ac = 3$ and $bd = -10$

or $ad + bc = -1$

M1

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

A1

$\frac{3x+5}{x+2}$

Do not ignore fw

A1

Additional Guidance

$\frac{(3x-5)(x+2)}{(x+2)(x-2)}$

M1
A0

$= \frac{(3x-5)}{(x-2)}$

A0

[9]

Q12.

$(3n - 1)(n - 2)$ or $(3n + 1)n$

or $n(n - 2)$ *as denominator on LHS*

M1

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

M1 dep

$3n^2 - 6n - n + 2$ or $-3n - n$

dep on first M1 only

M1 dep

$3n^2 - 6n - n + 2$ and $-3n - n$

Correct common denominators must be used for 4 marks to be awarded

A1

[4]