

A2 Partial Fractions Answers

P3

1	(i) State or imply $f(x) = \frac{A}{x-1} + \frac{B}{x-2} + \frac{C}{x+1}$	B1
	EITHER: Use any relevant method to obtain a constant	M1
	Obtain one of the values: $A = -1$, $B = 4$ and $C = -2$	A1
	Obtain the remaining two values	A1
	OR: Obtain one value by inspection	B1
	State a second value	B1
	State the third value	B1 4

[Apply the same scheme to the form $\frac{A}{x-2} + \frac{Bx+C}{x^2-1}$ which has $A = 4$, $B = -3$ and $C = 1$.]

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2 (a)(i)	State answer $\frac{A}{x+4} + \frac{Bx+C}{x^2+3}$	B1	1
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(ii)	State answer $\frac{A}{x-2} + \frac{Bx+C}{(x+2)^2}$ or $\frac{A}{x-2} + \frac{B}{x+2} + \frac{C}{(x+2)^2}$	B2	2
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[Award B1 if the B term is omitted or for the form $\frac{A}{x-2} + \frac{B}{x+2} + \frac{Cx+D}{(x+2)^2}$.]

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3	(i) State or imply partial fractions are of the form $\frac{A}{x+2} + \frac{Bx+C}{x^2+1}$	B1	
	Use any relevant method to obtain a constant	M1	
	Obtain $A = 2$	A1	
	Obtain $B = 1$	A1	
	Obtain $C = -1$	A1	[5]

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4	(i) State or imply partial fractions are of the form $\frac{A}{2-x} + \frac{Bx+C}{1+x^2}$	B1	
	Use any relevant method to obtain a constant	M1	
	Obtain one of the values $A = 2$, $B = 2$, $C = 4$	A1	
	Obtain a second value	A1	
	Obtain the third value	A1	5

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(i) EITHER: State or imply $f(x) = \frac{A}{2x+1} + \frac{B}{x+1} + \frac{C}{(x+1)^2}$

B1

Use any relevant method to obtain a constant
Obtain one of the values $A = 2, B = -1, C = 3$
Obtain the remaining two values

M1

A1

A1 + A1

[A correct solution starting with third term $\frac{Cx}{(x+1)^2}$ or $\frac{Cx+D}{(x+1)^2}$ is also possible.]

OR: State or imply $f(x) = \frac{A}{2x+1} + \frac{Dx+E}{(x+1)^2}$

B1

Use any relevant method to obtain a constant
Obtain one of the values $A = 2, D = -1, E = 2$
Obtain the remaining two values

M1

A1

A1 + A1

5

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6 (i) State or imply the form $\frac{A}{1-x} + \frac{B}{1+2x} + \frac{C}{2+x}$

B1

Use any relevant method to determine a constant

M1

Obtain $A = 1, B = 2$ and $C = -4$

A1 + A1 + A1

[5]

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7 (i) State or imply the form $A + \frac{B}{x+1} + \frac{C}{x+3}$

B1

State or obtain $A = 1$

B1

Use correct method for finding B or C

M1

Obtain $B = \frac{1}{2}$

A1

Obtain $C = -\frac{3}{2}$

A1

[5]

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8 (i) State or imply the form $\frac{A}{x} + \frac{B}{x^2} + \frac{C}{10-x}$

B1

Use any relevant method to determine a constant

M1

Obtain one of the values $A = 1, B = 10, C = 1$

A1

Obtain the remaining two values

A1

4

[The form $\frac{Dx+E}{x^2} + \frac{C}{10-x}$ is acceptable and leads to $D = 1, E = 10, C = 1$]

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9 (i) State or imply partial fractions are of the form $\frac{A}{x+1} + \frac{B}{(x+1)^2} + \frac{C}{3x+2}$

B1

Use any relevant method to obtain a constant

M1

Obtain one of the values $A = 1, B = 2, C = -3$

A1

Obtain a second value

A1

Obtain the third value

A1

[5]

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10 (i) State or imply partial fractions are of the form $\frac{A}{1-x} + \frac{Bx+C}{2+x^2}$ B1

Use a relevant method to determine a constant M1

Obtain $A = \frac{2}{3}$, $B = \frac{2}{3}$ and $C = \frac{1}{3}$ A1 + A1 + A1 [5]

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11 (i) State or imply the form $\frac{A}{x+1} + \frac{B}{x+3}$ and use a relevant method to find A or B M1

Obtain $A = 1$, $B = -1$ A1 [2]

(ii) Square the result of part (i) and substitute the fractions of part (i) M1
Obtain the given answer correctly A1 [2]

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12 (i) EITHER: Divide by denominator and obtain quadratic remainder M1

Obtain $A = 1$ A1

Use any relevant method to obtain B , C or D M1

Obtain one correct answer A1

Obtain $B = 2$, $C = 1$ and $D = -3$ A1

OR: Reduce RHS to a single fraction and equate numerators, or equivalent M1

Obtain $A = 1$ A1

Use any relevant method to obtain B , C or D M1

Obtain one correct answer A1

Obtain $B = 2$, $C = 1$ and $D = -3$ A1 [5]

[SR: If $A = 1$ stated without working give B1.]

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13 (i) State or imply the form $\frac{A}{1+x} + \frac{Bx+C}{1+2x^2}$ B1

Use any relevant method to evaluate a constant M1

Obtain one of $A = -1$, $B = 2$, $C = 1$ A1

Obtain a second value A1

Obtain the third value A1 [5]

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14 (i) State or imply partial fractions are of the form $\frac{A}{1+x} + \frac{Bx+C}{2+x^2}$ B1

Use a relevant method to determine a constant M1

Obtain one of the values $A = -2$, $B = 1$, $C = 4$ A1

Obtain a second value A1

Obtain the third value A1 [5]

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- 15 (i) Use any relevant method to determine a constant M1
 Obtain one of the values $A = 3$, $B = 4$, $C = 0$ A1
 Obtain a second value A1
 Obtain the third value A1 [4]

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- 16 (i) State or imply the form $A + \frac{B}{x+1} + \frac{C}{2x-3}$ B1
 State or obtain $A = 2$ B1
 Use a correct method for finding a constant M1
 Obtain $B = -2$ A1
 Obtain $C = -1$ A1 [5]

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- 17 (i) State or imply form $\frac{A}{3-x} + \frac{Bx+C}{1+x^2}$ B1
 Use relevant method to determine a constant M1
 Obtain $A = 6$ A1
 Obtain $B = -2$ A1
 Obtain $C = 1$ A1 [5]

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- 18 State or imply correct form $\frac{A}{x} + \frac{Bx+C}{x^2+1}$ B1
 Use any relevant method to find at least one constant M1
 Obtain $A = 2$ A1
 Obtain $B = 5$ A1
 Obtain $C = -3$ A1 [5]

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- 19 (i) Use any relevant method to determine a constant M1
 Obtain one of the values $A = 1$, $B = -2$, $C = 4$ A1
 Obtain a second value A1
 Obtain the third value A1 [4]
 [If A and C are found by the cover up rule, give B1 + B1 then M1A1 for finding B . If only one is found by the rule, give B1M1A1A1.]

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20	(i) State or imply partial fractions are of the form $\frac{A}{x-2} + \frac{Bx+C}{x^2+3}$	B1
	Use a relevant method to determine a constant	M1
	Obtain one of the values $A = -1$, $B = 3$, $C = -1$	A1
	Obtain a second value	A1
	Obtain the third value	A1 [5]

21	(i) Either State or imply form $\frac{A}{1+x} + \frac{B}{(1+x)^2} + \frac{C}{2-3x}$	B1
	Use any relevant method to find at least one constant	M1
	Obtain $A = -1$	A1
	Obtain $B = 3$	A1
	Obtain $C = 4$	A1
Or	State or imply form $\frac{A}{1+x} + \frac{Bx}{(1+x)^2} + \frac{C}{2-3x}$	B1
	Use any relevant method to find at least one constant	M1
	Obtain $A = 2$	A1
	Obtain $B = -3$	A1
	Obtain $C = 4$	A1
Or	State or imply form $\frac{Dx+E}{(1+x)^2} + \frac{F}{2-3x}$	B1
	Use any relevant method to find at least one constant	M1
	Obtain $D = -1$	A1
	Obtain $E = 2$	A1
	Obtain $F = 4$	A1 [5]

22	(i) Either State or imply partial fractions are of form $\frac{A}{3-x} + \frac{B}{1+2x} + \frac{C}{(1+2x)^2}$	B1
	Use any relevant method to obtain a constant	M1
	Obtain $A = 1$	A1
	Obtain $B = \frac{3}{2}$	A1
	Obtain $C = -\frac{1}{2}$	A1 [5]
Or	State or imply partial fractions are of form $\frac{A}{3-x} + \frac{Dx+E}{(1+2x)^2}$	B1
	Use any relevant method to obtain a constant	M1
	Obtain $A = 1$	A1
	Obtain $D = 3$	A1
	Obtain $E = 1$	A1 [5]

23	(i) Use a correct method for finding a constant Obtain one of $A = 3, B = 3, C = 0$ Obtain a second value Obtain a third value	M1 A1 A1 A1 4
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24	(i) State or imply the form $\frac{A}{1-x} + \frac{B}{2-x} + \frac{C}{(2-x)^2}$ Use a correct method to determine a constant Obtain one of $A = 2, B = -1, C = 3$ Obtain a second value Obtain a third value	B1 M1 A1 A1 A1 [5]
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[The alternative form $\frac{A}{1-x} + \frac{Dx+E}{(2-x)^2}$, where $A = 2, D = 1, E = 1$ is marked]

B1M1A1A1A1 as above.]

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25	(i) State or imply the form $\frac{A}{3-2x} + \frac{Bx+C}{x^2+4}$ Use a relevant method to determine a constant Obtain one of the values $A = 3, B = -1, C = -2$ Obtain a second value Obtain the third value	B1 M1 A1 A1 A1 [5]
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26	(i) State or imply $f(x) \equiv \frac{A}{2x-1} + \frac{B}{x+2} + \frac{C}{(x+2)^2}$ Use a relevant method to determine a constant Obtain one of the values $A = 2, B = -1, C = 3$ Obtain the remaining values A1 + [Apply an analogous scheme to the form $\frac{A}{2x-1} + \frac{Dx+E}{(x+2)^2}$; the values being $A = 2,$ $D = -1, E = 1.$]	B1 M1 A1 A1 5
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27	(i) State or imply the form $\frac{A}{x+1} + \frac{B}{x-3} + \frac{C}{(x-3)^2}$ Use a correct method to determine a constant Obtain one of the values $A = 1, B = 3, C = 12$ Obtain a second value Obtain a third value	B1 M1 A1 A1 A1 [5]
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[Mark the form $\frac{A}{x+1} + \frac{Dx+E}{(x-3)^2}$, where $A = 1, D = 3, E = 3$, B1M1A1A1A1 as above.]

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28	(i) State or imply the form $A + \frac{B}{2x+1} + \frac{C}{x+2}$	B1
	State or obtain $A = 2$	B1
	Use a correct method for finding a constant	M1
	Obtain one of $B = 1, C = -2$	A1
	Obtain the other value	A1 [5]

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[2]

29	(i) State or imply the form $\frac{A}{x+3} + \frac{B}{x-1} + \frac{C}{(x-1)^2}$	B1
	Use a correct method to determine a constant	M1
	Obtain one of the values $A = -3, B = 1, C = 2$	A1
	Obtain a second value	A1
	Obtain the third value	A1
	[Mark the form $\frac{A}{x+3} + \frac{Dx+E}{(x-1)^2}$, where $A = -3, D = 1, E = 1$, B1M1A1A1A1 as above.]	[5]

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30	(i) State or imply the form $\frac{A}{x+2} + \frac{Bx+C}{x^2+4}$	B1	
	Use a correct method to determine a constant	M1	
	Obtain one of $A = 2, B = 1, C = -1$	A1	
	Obtain a second value	A1	
	Obtain a third value	A1	[5]

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31(i)	Carry out a relevant method to obtain A and B such that $\frac{1}{x(2x+3)} \equiv \frac{A}{x} + \frac{B}{2x+3}$, or equivalent	
	Obtain $A = \frac{1}{3}$ and $B = -\frac{2}{3}$, or equivalent	
	Total:	2

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32(i)	State or imply the form $\frac{A}{3x+2} + \frac{Bx+C}{x^2+5}$	B1
	Use a relevant method to determine a constant	M1
	Obtain one of the values $A = 2, B = 1, C = -3$	A1
	Obtain a second value	A1
	Obtain the third value	A1
	Total:	5

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33(i)	State or imply the form $\frac{A}{x} + \frac{B}{x^2} + \frac{C}{3x+2}$	B1
	Use a relevant method to determine a constant	M1
	Obtain one of the values $A = 3, B = -2, C = -6$	A1
	Obtain a second value	A1
	Obtain the third value [Mark the form $\frac{Ax+B}{x^2} + \frac{C}{3x+2}$ using same pattern of marks.]	A1
	Total:	5

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34(i)	Use a relevant method to determine a constant	M1
	Obtain one of the values $A = 2, B = 2, C = -1$	A1
	Obtain a second value	A1
	Obtain the third value	A1
	4	

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35(i)

State or imply the form $\frac{A}{1-x} + \frac{B}{2x+3} + \frac{C}{(2x+3)^2}$	B1
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Use a relevant method to determine a constant	M1
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Obtain one of the values $A = 1, B = -2, C = 5$	A1
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Obtain a second value	A1
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Obtain the third value	A1
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	5
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[Mark the form $\frac{A}{1-x} + \frac{Dx+E}{(2x+3)^2}$, where $A = 1, D = -4, E = -1$, B1M1A1A1A1 as above.]	
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36(i)

State or imply the form $A + \frac{B}{x-1} + \frac{C}{3x+2}$	B1
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State or obtain $A = 4$	B1
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Use a correct method to obtain a constant	M1
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Obtain one of $B = 3, C = -1$	A1
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Obtain the other value	A1
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	5
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37(i)

Use a correct method to find a constant	M1
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Obtain one of the values $A = -3, B = 1, C = 2$	A1
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Obtain a second value	A1
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Obtain the third value	A1
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	4
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38 (i)	<p>Carry out relevant method to find A and B such that</p> $\frac{1}{4-y^2} \equiv \frac{A}{2+y} + \frac{B}{2-y}$	M1
	<p>Obtain $A = B = \frac{1}{4}$</p>	A1
	Total:	2

39(i)	<p>State or imply the form $\frac{A}{2-x} + \frac{B}{3+2x} + \frac{C}{(3+2x)^2}$</p>	B1
	<p>Use a correct method to find a constant</p>	M1
	<p>Obtain one of $A = 1, B = -1, C = 3$</p>	A1
	<p>Obtain a second value</p>	A1
	<p>Obtain the third value [Mark the form $\frac{A}{2-x} + \frac{Dx+E}{(3+2x)^2}$, where $A = 1, D = -2$ and $E = 0$, B1M1A1A1A1 as above.]</p>	A1
		5

40(i)	<p>State or imply the form $\frac{A}{1-2x} + \frac{B}{2-x} + \frac{C}{(2-x)^2}$</p>	B1
	<p>Use a correct method for finding a constant M1 is available following a single slip in working from their form but no A marks (even if a constant is “correct”)</p>	M1
	<p>Obtain one of $A = 1, B = 3, C = -2$</p>	A1
	<p>Obtain a second value</p>	A1
	<p>Obtain the third value [Mark the form $\frac{A}{1-2x} + \frac{Dx+E}{(2-x)^2}$, where $A = 1, D = -3$ and $E = 4$, B1M1A1A1A1 as above.]</p>	A1
		5

41(i)

	State or imply the form $\frac{A}{2+x} + \frac{B}{3-x} + \frac{C}{(3-x)^2}$	B1	
	Use a correct method to obtain a constant	M1	
	Obtain one of $A = 2, B = 2, C = -7$	A1	
	Obtain a second value	A1	
	Obtain the third value	A1	[Mark the form $\frac{A}{2+x} + \frac{Dx+E}{(3-x)^2}$, where $A = 1, D = -2$ and $E = -1$, B1M1A1A1A1.]
		5	

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42(i)

	State or imply the form $\frac{A}{2x+1} + \frac{B}{2x+3} + \frac{C}{(2x+3)^2}$	B1	
	Use a correct method to find a constant	M1	
	Obtain the values $A = 1, B = -1, C = 3$	A1 A1 A1	
	[Mark the form $\frac{A}{2x+1} + \frac{Dx+E}{(2x+3)^2}$, where $A = 1, D = -2$ and $E = 0$, B1M1A1A1A1 as above.]		
		5	

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43(i)

	State or imply the form $\frac{A}{3+x} + \frac{B}{1-x} + \frac{C}{(1-x)^2}$	B1	
	Use a correct method for finding a constant	M1	
	Obtain one of $A = -3, B = -1, C = 2$	A1	
	Obtain a second value	A1	
	Obtain the third value	A1	Mark the form
		5	

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44(i)

State or imply the form $\frac{A}{x} + \frac{B}{x^2} + \frac{C}{x-2}$	B1
Use a correct method for finding a constant	M1
Obtain one of $A = -1, B = 3, C = 2$	A1
Obtain a second value	A1
Obtain the third value	A1 Allow in the form
	5

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Answer	Marks
State or imply the form $\frac{A}{2x-1} + \frac{Bx+C}{x^2+2}$	B1
Use a correct method for finding a constant	M1
Obtain one of $A = 4, B = -1, C = 0$	A1
Obtain a second value	A1
Obtain the third value	A1
	5

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