

Q1.

- 9 (i) State or imply partial fractions of the form $\frac{A}{1-2x} + \frac{B}{2+x} + \frac{C}{(2+x)^2}$ B1
- Use any relevant method to determine a constant M1
 Obtain one of the values $A = 1, B = 1, C = -2$ A1
 Obtain a second value A1
 Obtain the third value A1 [5]
- [The form $\frac{A}{1-2x} + \frac{Dx+E}{(2+x)^2}$, where $A = 1, D = 1, E = 0$, is acceptable
 scoring B1M1A1A1A1 as above.]
- (ii) Use correct method to obtain the first two terms of the expansion of $(1-2x)^{-1}, (2+x)^{-1},$
 $(2+x)^{-2}, (1+\frac{1}{2}x)^{-1},$ or $(1+\frac{1}{2}x)^{-2}$ M1
 Obtain correct unsimplified expansions up to the term in x^2 of each partial fraction $A1\sqrt{+} A1\sqrt{+} A1\sqrt{+}$
 Obtain answer $1 + \frac{9}{4}x + \frac{15}{4}x^2$, or equivalent A1 [5]
- [Symbolic binomial coefficients, e.g. $\binom{-1}{1}$, are not sufficient for the M1. The f.t. is on A, B, C .]
 [For the A, D, E form of partial fractions, give M1A1√A1√ for the expansions then, if $D \neq 0$, M1 for multiplying out fully and A1 for the final answer.]
 [In the case of an attempt to expand $(4+5x-x^2)(1-2x)^{-1}(2+x)^{-2}$, give M1A1A1 for the expansions, M1 for multiplying out fully, and A1 for the final answer.]
 [SR: If B or C omitted from the form of fractions, give B0M1A0A0A0 in (i); M1A1√A1√ in (ii).]
 [SR: If D or E omitted from the form of fractions, give B0M1A0A0A0 in (i); M1A1√A1√ in (ii).]

Q2.

- 1 Either: Obtain $1 + \frac{1}{3}kx$, where $k = \pm 6$ or ± 1 M1
 Obtain $1 - 2x$ A1
 Obtain $-4x^2$ A1
 Obtain $-\frac{40}{3}x^3$ or equivalent A1
- Or: Differentiate expression to obtain form $k(1-6x)^{-\frac{2}{3}}$ and evaluate $f(0)$ and $f'(0)$ M1
 Obtain $f'(x) = -2(1-6x)^{-\frac{2}{3}}$ and hence the correct first two terms $1 - 2x$ A1
 Obtain $f''(x) = -8(1-6x)^{-\frac{5}{3}}$ and hence $-4x^2$ A1
 Obtain $f'''(x) = -80(1-6x)^{-\frac{8}{3}}$ and hence $-\frac{40}{3}x^3$ or equivalent A1 [4]

Q3.

- 2 (i) Either Obtain correct (unsimplified) version of x or x^2 term from $(1-4x)^{\frac{1}{2}}$ M1
 Obtain $1+2x$ A1
 Obtain $+6x^2$ A1
- Or Differentiate and evaluate $f(0)$ and $f'(0)$ where $f(x) = k(1-4x)^{-\frac{3}{2}}$ M1
 Obtain $1+2x$ A1
 Obtain $+6x^2$ A1 [3]
- (ii) Combine both x^2 terms from product of $1+2x$ and answer from part (i) M1
 Obtain 5 A1 [2]

Q4.

- 1 *EITHER*: Obtain a correct unsimplified version of the x or x^2 term of the expansion of $(4+3x)^{-\frac{1}{2}}$ or $(1+\frac{3}{4}x)^{-\frac{1}{2}}$ M1
 State correct first term $\frac{1}{2}$ B1
 Obtain the next two terms $-\frac{3}{16}x + \frac{27}{256}x^2$ A1 + A1
- OR*: Differentiate and evaluate $f(0)$ and $f'(0)$, where $f'(x) = k(4+3x)^{-\frac{3}{2}}$ M1
 State correct first term $\frac{1}{2}$ B1
 Obtain the next two terms $-\frac{3}{16}x + \frac{27}{256}x^2$ A1 + A1 [4]
- [Symbolic coefficients, e.g. $(-\frac{1}{2})$ are not sufficient for the M or B mark.]

Q5.

- 2 Obtain $1-x$ as first two terms of $(1+2x)^{-\frac{1}{2}}$ B1
 Obtain $+\frac{3}{2}x^2$ or unsimplified equivalent as third term of $(1+2x)^{-\frac{1}{2}}$ B1
 Multiply $1+3x$ by attempt at $(1+2x)^{-\frac{1}{2}}$, obtaining sufficient terms M1
 Obtain final answer $1+2x-\frac{3}{2}x^2$ A1 [4]

Q6.

- 3 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]

Q7.

- 8 (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]
- (ii) Use correct method to obtain the first two terms of the expansion of $(x+1)^{-1}, (x+1)^{-2}, (3x+2)^{-1}$ or $(1 + \frac{3}{2}x)^{-1}$ M1
 Obtain correct unsimplified expansion up to the term in x^2 of each partial fraction A1√ + A1√ + A1√
 Obtain answer $\frac{3}{2} - \frac{11}{4}x + \frac{29}{8}x^2$, or equivalent A1 [5]
- [Symbolic binomial coefficients, e.g. $\binom{-1}{1}$, are not sufficient for the first M1. The f.t. is on A, B, C .]
- [The form $\frac{Dx+E}{(x+1)^2} + \frac{C}{3x+2}$, where $D = 1, E = 3, C = -3$, is acceptable. In part (i) give B1M1A1A1A1.
 In part (ii) give M1A1√A1√ for the expansions, and, if $DE \neq 0$, M1 for multiplying out fully and A1 for the final answer.]
 [If B or C omitted from the form of fractions, give B0M1A0A0A0 in (i); M1A1√A1√ in (ii), max 4/10]
 [If D or E omitted from the form of fractions, give B0M1A0A0A0 in (i); M1A1√A1√ in (ii), max 4/10]
 [In the case of an attempt to expand $(5x+3)(x+1)^{-2}(3x+2)^{-1}$, give M1A1A1 for the expansions, M1 for multiplying out fully, and A1 for the final answer.]
 [Allow use of Maclaurin, giving M1A1√A1√ for differentiating and obtaining $f(0) = \frac{3}{2}$ and $f'(0) = -\frac{11}{4}$, A1√ for $f''(0) = \frac{29}{4}$, and A1 for the final answer (the f.t. is on A, B, C if used).]

Q8.

- 8 (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]

- (ii) Use correct method to obtain the first two terms of the expansion of $(1+x)^{-1}$ or $(1+2x^2)^{-1}$ M1
 Obtain correct expansion of each partial fraction as far as necessary A1√ + A1√
 Multiply out fully by $Bx + C$, where $BC \neq 0$ M1
 Obtain answer $3x - 3x^2 - 3x^3$ A1 [5]

[Symbolic binomial coefficients, e.g., $\binom{-1}{1}$ are not sufficient for the first M1. The f.t.

is on A, B, C .]

[If B or C omitted from the form of fractions, give B0M1A0A0A0 in (i); M1A1√A1√ in (ii), max 4/10.]

[If a constant D is added to the correct form, give M1A1A1A1 and B1 if and only if $D = 0$ is stated.]

[If an extra term $D/(1+2x^2)$ is added, give B1M1A1A1, and A1 if $C + D = 1$ is resolved to $1/(1+2x^2)$.]

[In the case of an attempt to expand $3x(1+x)^{-1}(1+2x^2)^{-1}$, give M1A1A1 for the expansions up to the term in x^2 , M1 for multiplying out fully, and A1 for the final answer.]

[For the identity $3x \equiv (1+x+2x^2+2x^3)(a+bx+cx^2+dx^3)$ give M1A1; then M1A1 for using a relevant method to find two of $a = 0, b = 3, c = -3$ and $d = -3$; and then A1 for the final answer in series form.]

Q9.

- 1 Obtain $1 - 6x$ B1
 State correct unsimplified x^2 term. Binomial coefficients must be expanded. M1
 Obtain $\dots + 24x^2$ A1 [3]

Q10.

1	<p>Either</p> <p>Obtain correct unsimplified version of x or x^2 term in expansion of $(2+x)^{-2}$ or $(1 + \frac{1}{2}x)^{-2}$</p> <p>Correct first term 4 from correct work</p> <p>Obtain $-4x$</p> <p>Obtain $+3x^2$</p> <p>Or</p> <p>Differentiate and evaluate $f(0)$ and $f'(0)$ where $f'(x) = k(2+x)^{-3}$</p> <p>State correct first term 4</p> <p>Obtain $-4x$</p> <p>Obtain $+3x^2$</p>	<p>M1</p> <p>B1</p> <p>A1</p> <p>A1</p> <p>M1</p> <p>B1</p> <p>A1</p> <p>A1</p>	[4]
----------	---	---	-----

Q11.

- 4 (i) Obtain correct unsimplified terms in x and x^3 B1 + B1
 Equate coefficients and solve for a M1
 Obtain final answer $a = \frac{1}{\sqrt{2}}$, or exact equivalent A1 [4]
- (ii) Use correct method and value of a to find the first two terms of the expansion $(1 + ax)^{-2}$ M1
 Obtain $1 - \sqrt{2}x$, or equivalent A1 ✓
 Obtain term $\frac{3}{2}x^2$ A1 ✓ [3]
 [Symbolic coefficients, e.g. a , are not sufficient for the first B marks]
 [The f.t. is solely on the value of a .]

Q12.

- 9 (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]
- (ii) Either Use correct method to obtain first two terms of expansion
 of $(3-x)^{-1}$ or $\left(1-\frac{1}{3}x\right)^{-1}$ or $(1+x^2)^{-1}$ M1
 Obtain $\frac{A}{3}\left(1+\frac{1}{3}x+\frac{1}{9}x^2+\frac{1}{27}x^3\right)$ A1
 Obtain $(Bx+C)(1-x^2)$ A1
 Obtain sufficient terms of the product $(Bx+C)(1-x^2)$, $B, C \neq 0$ and add the two expansions M1
 Obtain final answer $3-\frac{4}{3}x-\frac{7}{9}x^2+\frac{56}{27}x^3$ A1
- Or Use correct method to obtain first two terms of expansion
 of $(3-x)^{-1}$ or $\left(1-\frac{1}{3}x\right)^{-1}$ or $(1+x^2)^{-1}$ M1
 Obtain $\frac{1}{3}\left(1+\frac{1}{3}x+\frac{1}{9}x^2+\frac{1}{27}x^3\right)$ A1
 Obtain $(1-x^2)$ A1
 Obtain sufficient terms of the product of the three factors M1
 Obtain final answer $3-\frac{4}{3}x-\frac{7}{9}x^2+\frac{56}{27}x^3$ A1 [5]

Q13.

- 7 (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]
- (ii) Use correct method to obtain the first two terms of the expansions of $(x-2)^{-1}$,
 $\left(1-\frac{1}{2}x\right)^{-1}$, $(x^2+3)^{-1}$ or $\left(1+\frac{1}{3}x^2\right)^{-1}$ M1
 Substitute correct unsimplified expansions up to the term in x^2 into each partial fraction A1²+A1²
 Multiply out fully by $Bx+C$, where $BC \neq 0$ M1
 Obtain final answer $\frac{1}{6} + \frac{5}{4}x + \frac{17}{72}x^2$, or equivalent A1 [5]
- [Symbolic binomial coefficients, e.g. $\binom{-1}{1}$ are not sufficient for the M1. The f.t. is on A, B, C .]
 [In the case of an attempt to expand $(2x^2-7x-1)(x-2)^{-1}(x^2+3)^{-1}$, give M1A1A1 for the expansions, M1 for multiplying out fully, and A1 for the final answer.]
 [If B or C omitted from the form of partial fractions, give B0M1A0A0A0 in (i); M1A1²A1² in (ii)]

Q14.

- 8 (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]

- (ii) Either Use correct method to find first two terms of expansion of $(1+x)^{-1}$ or
 $(1+x)^{-2}$ or $(2-3x)^{-1}$ or $\left(1-\frac{3}{2}x\right)^{-1}$ M1
 Obtain correct unsimplified expansion of first partial fraction up to x^2 term A1√
 Obtain correct unsimplified expansion of second partial fraction up to x^2 term A1√
 Obtain correct unsimplified expansion of third partial fraction up to x^2 term A1√
 Obtain final answer $4-2x+\frac{25}{2}x^2$ A1
- Or 1 Use correct method to find first two terms of expansion of $(1+x)^{-2}$
 or $(2-3x)^{-1}$ or $\left(1-\frac{3}{2}x\right)^{-1}$ M1
 Obtain correct unsimplified expansion of first partial fraction up to x^2 term A1√
 Obtain correct unsimplified expansion of second partial fraction up to x^2 term A1√
 Expand and obtain sufficient terms to obtain three terms M1
 Obtain final answer $4-2x+\frac{25}{2}x^2$ A1
- Or 2 (expanding original expression)
 Use correct method to find first two terms of expansion of $(1+x)^{-2}$
 or $(2-3x)^{-1}$ or $\left(1-\frac{3}{2}x\right)^{-1}$ M1
 Obtain correct expansion $1-2x+3x^2$ or unsimplified equivalent A1
 Obtain correct expansion $\frac{1}{2}\left(1+\frac{3}{2}x+\frac{9}{4}x^2\right)$ or unsimplified equivalent A1
 Expand and obtain sufficient terms to obtain three terms M1
 Obtain final answer $4-2x+\frac{25}{2}x^2$ A1
- Or 3 (McLaurin expansion)
 Obtain first derivative $f'(x)=(1+x)^{-2}-6(1+x)^{-3}+12(2-3x)^{-2}$ M1
 Obtain $f'(0)=1-6+3$ or equivalent A1
 Obtain $f''(0)=-2+18+9$ or equivalent A1
 Use correct form for McLaurin expansion M1
 Obtain final answer $4-2x+\frac{25}{2}x^2$ A1 [5]

Q15.

- 9 (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]
- (ii) Obtain the first two terms of one of the expansion of $(3-x)^{-1}, \left(1-\frac{1}{3}x\right)^{-1}$
- $(1+2x)^{-1}$ and $(1+2x)^{-2}$ M1
- Obtain correct unsimplified expansion up to the term in x^2 of each partial fraction, following in each case the value of A, B, C A1✓
A1✓
A1✓
- Obtain answer $\frac{4}{3} - \frac{8}{9}x + \frac{1}{27}x^2$ A1 [5]
- [If A, D, E approach used in part (i), give M1A1✓A1✓ for the expansions, M1 for multiplying out fully and A1 for final answer]

Q16.

- 2 State a correct unsimplified version of the x or x^2 or x^3 term M1
- State correct first two terms $1 - x$ A1
- Obtain the next two terms $2x^2 - \frac{14}{3}x^3$ A1 + A1 4
- [Symbolic binomial coefficients, e.g. $\binom{-\frac{1}{3}}{3}$ are not sufficient for the M mark.]

Q17.

- 9 (i) State or imply the form $\frac{A}{1-x} + \frac{B}{2-x} + \frac{C}{(2-x)^2}$ B1
- Use a correct method to determine a constant M1
- Obtain one of $A = 2, B = -1, C = 3$ A1
- Obtain a second value A1
- Obtain a third value A1 [5]
- [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.]
- (ii) Use correct method to find the first two terms of the expansion of $(1-x)^{-1}, (2-x)^{-1}, (2-x)^{-2}, (1-\frac{1}{2}x)^{-1}$ or $(1-\frac{1}{2}x)^{-2}$ M1
- Obtain correct unsimplified expansions up to the term in x^2 of each partial fraction A1✓ + A1✓ + A1✓
- Obtain final answer $\frac{9}{4} + \frac{5}{2}x + \frac{39}{16}x^2$, or equivalent A1 [5]
- [Symbolic binomial coefficients, e.g. $\binom{-1}{1}$ are not sufficient for M1. The ✓ is on A, B, C .]
- [For the A, D, E form of partial fractions, give M1 A1✓ A1✓ for the expansions then, if $D \neq 0$, M1 for multiplying out fully and A1 for the final answer.]
- [In the case of an attempt to expand $(x^2 - 8x + 9)(1-x)^{-1}(2-x)^{-2}$, give M1A1A1 for the expansions, M1 for multiplying out fully, and A1 for the final answer.]

[Online Classes : Megalecture@gmail.com](mailto:Megalecture@gmail.com)
www.youtube.com/megalecture
www.megalecture.com