1.8 Pure: Integration

EDEXCEL 9MA0 · Calculator allowed · about 220 minutes · Write-in edition

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 This question tests integration of e^{kx} and $1/x$, and finding a particular solution using a given point.

(a) Find integral of $(e^{2x} + 3/x)\,dx$, for $x > 0$. **(2)**

(b) A curve C has $dy/dx = 6x^2 - e^{-x}$, and C passes through the point (0, 5). Find y in terms of x. **(4)**

(c) Hence find the gradient of C at the point where $x = 0$. **(2)**

(Total for Question 1 is 8 marks)

2 This question tests integration by inspection (reverse chain rule).

(a) Find integral of $(2x + 1)^5$ dx. **(3)**

(b) Find integral of $x/(x^2 + 4)$ dx. **(3)**

(c) Find integral of $\cos(3x - 1)$ dx. **(3)**

(Total for Question 2 is 9 marks)

3 The curve C has equation $y = 2x^2 + 2x - 3$ and the line l has equation $y = 18x - 27$. The curve and the line meet at the points A and B.

(a) Find the coordinates of A and B. **(3)**

(b) Find the area of the finite region bounded by the curve and the line. **(4)**

(Total for Question 3 is 7 marks)

4 Use the substitution $u = x^2$ to answer this question.

(a) Find integral of $x\, e^{x^2}\, dx$. **(3)**

(b) Hence find the exact value of the integral from $x = 0$ to $x = 1$ of $x\, e^{x^2}\, dx$. **(2)**

(Total for Question 4 is 5 marks)

5 The curve C has equation $y = x(x - 6)(x - 7)$. The curve crosses the x-axis at the origin and at the points A(6, 0) and B(7, 0). The finite region R_1 lies between the origin and A, and the finite region R_2 lies between A and B.

(a) Show that $y = x^3 - 13x^2 + 42x$. **(2)**

(b) Find integral of y dx. **(2)**

(c) Find the exact area of R_1 and the exact area of R_2. **(4)**

(d) Hence find the total area enclosed between the curve and the x-axis from $x = 0$ to $x = 7$. **(2)**

(Total for Question 5 is 10 marks)

6 The curve C has equation $y = 2x^2 - 3x + 5$ and the line l has equation $y = 5x - 1$. The curve and the line meet at the points A and B.

(a) Find the coordinates of A and B. **(3)**

(b) Find the area of the finite region bounded by the curve and the line. **(4)**

(Total for Question 6 is 7 marks)

7 $f(x) = x^2 - 4x^{-1/2} - 1, x > 0.$

(a) Find integral of f(x) dx, simplifying your answer. **(3)**

(b) Hence find the exact value of the integral from x = 1 to x = 4 of f(x) dx. **(3)**

(Total for Question 7 is 6 marks)

8 $f(x) = (x - 1)/((x - 2)(x - 3))$, $x > 3$.

(a) Express $f(x)$ in partial fractions. **(3)**

(b) Hence find the exact value of the integral from $x = 4$ to $x = 7$ of $f(x)\,dx$. **(4)**

(Total for Question 8 is 7 marks)

9 The curve C has equation $y = x(x - 2)(x - 3)$. The curve crosses the x-axis at the origin and at the points A(2, 0) and B(3, 0). The finite region R_1 lies between the origin and A, and the finite region R_2 lies between A and B.

(a) Show that $y = x^3 - 5x^2 + 6x$. **(2)**

(b) Find integral of y dx. **(2)**

(c) Find the exact area of R_1 and the exact area of R_2. **(4)**

(d) Hence find the total area enclosed between the curve and the x-axis from $x = 0$ to $x = 3$. **(2)**

(Total for Question 9 is 10 marks)

10 $f(x) = (6x - 16)/((x - 2)(x - 3))$, $x > 3$.

(a) Express $f(x)$ in partial fractions. **(3)**

(b) Hence find the exact value of the integral from $x = 4$ to $x = 7$ of $f(x)\,dx$. **(4)**

(Total for Question 10 is 7 marks)

11 Use integration by parts to answer this question.

(a) Find integral of $x\, e^{2x}\, dx$. **(3)**

(b) Hence find the exact value of the integral from $x = 0$ to $x = 1$ of $x\, e^{2x}\, dx$. **(2)**

(Total for Question 11 is 5 marks)

12 The curve C has equation $y = x^3 - 4x$.

(a) Show that the definite integral, from $x = 0$ to $x = 2$, of $(x^3 - 4x)\,dx$ equals -4. **(2)**

(b) Explain why the value found in part (a) is not the area of the region bounded by C and the x-axis between $x = 0$ and $x = 2$, and state the area of this region. **(2)**

(c) Find the total area enclosed between the curve C and the x-axis for $0 \leq x \leq 3$. **(5)**

(Total for Question 12 is 9 marks)

13 The curve C has equation $y = 6x - x^2$, and the line l has equation $y = 2x$.

(a) Find the coordinates of the points of intersection of C and l. **(3)**

(b) Find the area of the region enclosed by C and l. **(4)**

(Total for Question 13 is 7 marks)

14 The table shows values of $y = \sqrt{1 + x^3}$, for $0 \leq x \leq 2$.

x	0	0.5	1	1.5	2
y	1	1.0607	?	2.0917	3

x	y
0	1
0.5	1.0607
1	?
1.5	2.0917
2	3

(a) Complete the table by finding the value of y at x = 1, giving your answer to 4 decimal places. **(2)**

(b) Using the trapezium rule with all five values in the table (strip width h = 0.5), find an estimate for the definite integral, from x = 0 to x = 2, of $\sqrt{1 + x^3}$ dx, giving your answer to 3 significant figures. **(3)**

(c) State, with a reason, whether the trapezium rule estimate found in part (b) is an overestimate or an underestimate of the true value of the integral. **(2)**

(Total for Question 14 is 7 marks)

15 Find the integral of x^3 with respect to x.

(Total for Question 15 is 1 mark)

16 Find the integral of (4x - 3) with respect to x.

(Total for Question 16 is 1 mark)

17 This question tests integration by substitution.

(a) Using the substitution $u = 2x - 1$, find integral of $x*\sqrt{2x - 1}\ dx$. **(5)**

(b) Hence evaluate the definite integral, from $x = 1$ to $x = 5$, of $x*\sqrt{2x - 1}\ dx$, giving your answer as an exact fraction. **(3)**

(Total for Question 17 is 8 marks)

18 This question tests integration of trigonometric functions using double angle identities.

(a) Using the identity $\cos(2A) = 1 - 2\sin^2(A)$, or otherwise, find integral of $\sin^2(x)$ dx. **(3)**

(b) Find integral of $\cos^2(3x)$ dx. **(4)**

(c) Hence evaluate the definite integral, from $x = 0$ to $x = \pi/6$, of $\cos^2(3x)$ dx, giving your answer in terms of π. **(3)**

(Total for Question 18 is 10 marks)

19 This question tests integration by parts.

(a) Find integral of x*sin(2x) dx, using integration by parts. **(5)**

(b) Find integral of $x^2 * \ln(x)$ dx, for $x > 0$, using integration by parts. **(5)**

(Total for Question 19 is 10 marks)

20 Find the integral of x^{-2} with respect to x.

(Total for Question 20 is 1 mark)

21 Find the integral of e^{4x} with respect to x.

(Total for Question 21 is 1 mark)

22 Evaluate the definite integral, from x = 1 to x = 3, of 2x dx.

(Total for Question 22 is 1 mark)

23 Find the integral of $\sqrt{x}$ with respect to x.

(Total for Question 23 is 1 mark)

24 Find the integral of $\cos(2x)$ with respect to x.

(Total for Question 24 is 1 mark)

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25 Find the integral of $(3/x + 2e^x)$ with respect to x, for $x > 0$.

(Total for Question 25 is 2 marks)

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26 Using inspection (the reverse chain rule), find the integral of $(2x + 5)^3$ with respect to x.

(Total for Question 26 is 2 marks)

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27 Find the integral of $\sin(4x - 1)$ with respect to x.

(Total for Question 27 is 2 marks)

28 The curve C has equation $y = 8x - x^2$, and the line l has equation $y = 3x$. Find the coordinates of the points of intersection of C and l, and find the area of the region enclosed by C and l.

(Total for Question 28 is 3 marks)

29 Find the total area enclosed between the curve C: $y = x^2 - 4x$ and the x-axis, for $0 \leq x \leq 6$.

(Total for Question 29 is 3 marks)

30 Find the integral of $(6x^2 - 4x^{-1/2})$ with respect to x.

(Total for Question 30 is 2 marks)

31 A curve C has parametric equations $x = t^2$, $y = 3 - t$, for $0 \leq t \leq 3$.

(a) Find dx/dt. **(1)**

(b) Show that C crosses the x-axis at the point where t = 3, and find the coordinates of this point. **(2)**

(c) Use the formula Area = integral of y*(dx/dt) dt to find the area of the region bounded by the curve C, the x-axis and the y-axis. **(5)**

(d) Verify your answer to part (c) by finding the Cartesian equation of C in the form $y = f(x)$, and evaluating the appropriate definite integral in x. **(4)**

(Total for Question 31 is 12 marks)

32 Using the substitution u = 2x + 1, find the integral of $x*\sqrt{2x + 1}$ with respect to x. Hence evaluate the definite integral, from x = 0 to x = 4, of $x*\sqrt{2x + 1}$ dx, giving your answer as an exact value.

(Total for Question 32 is 3 marks)

33 f(x) = (7x - 16) / ((x - 2)(x - 3)), for x > 3. Express f(x) in the form A/(x - 2) + B/(x - 3), where A and B are integers to be found. Hence find the integral of f(x) with respect to x, and show that the definite integral, from x = 4 to x = 5, of f(x) dx equals ln(k), finding the exact value of k.

(Total for Question 33 is 4 marks)

Mark scheme · 1.8 Pure: Integration

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

(a) $(1/2)e^{2x}$ term correct **M1**
(a) 3 ln x + c, all correct oe **A1**
(a) Answer: $(1/2)e^{2x}$ + 3 ln x + c
(b) integrate $6x^2$ to $2x^3$ **M1**
(b) integrate $-e^{-x}$ to e^{-x}, sign correct **M1**
(b) substitute x = 0, y = 5 to find the constant **M1**
(b) $y = 2x^3 + e^{-x} + 4$, cao **A1**
(b) Answer: $y = 2x^3 + e^{-x} + 4$
(c) substitute x = 0 into $6x^2 - e^{-x}$ **M1**
(c) -1, cao **A1**
(c) Answer: -1

Question 2

(a) attempt at $(2x+1)^6$ form **M1**
(a) divide by 12 (their coefficient from the chain rule), dep **M1**
(a) $(2x+1)^6 / 12 + c$, cao **A1**
(a) Answer: $(2x + 1)^6 / 12 + c$
(b) recognise numerator is (1/2) x derivative of denominator **M1**
(b) (1/2) $\ln(x^2 + 4)$ **A1**
(b) + c present **B1**
(b) Answer: (1/2) $\ln(x^2 + 4)$ + c
(c) sin(3x - 1) form seen **M1**
(c) coefficient 1/3 correct **A1**
(c) + c present **B1**
(c) Answer: (1/3) sin(3x - 1) + c

Question 3

(a) equates the expressions for y and rearranges to a quadratic **M1**
(a) x = 2 and x = 6 **A1**
(a) (2, 9) and (6, 81) **A1**
(a) Answer: A(2, 9), B(6, 81)
(b) area = integral of (line - curve) or of (curve - line) between the x values **M1**
(b) integrand $2x^2 - 16x + 24$ **A1**
(b) integrates and substitutes the limits **M1**
(b) 64/3 **A1**
(b) Answer: 64/3

Question 4

(a) du = 2x dx **M1**
(a) integral of e^u du x 1/2 **M1**
(a) $1/2e^{x^2}$ + c **A1**
(a) Answer: $1/2e^{x^2}$ + c
(b) substitutes the limits **M1**
(b) 1/2(e - 1) **A1**
(b) Answer: 1/2(e - 1)

Question 5

(a) multiplies out two brackets **M1**
(a) $x^3 - 13x^2 + 42x$ (cso) **A1**
(a) Answer: $y = x^3 - 13x^2 + 42x$
(b) integrates term by term, raising each power by 1 **M1**
(b) $x^4/4 - 13/3x^3 + 21x^2$ (+ c) **A1**
(b) Answer: $(1/4)x^4 - (13/3)x^3 + 21x^2$ + c
(c) evaluates the integral between 0 and 6 for R_1 **M1**
(c) area of R_1 = 144 (the integral is 144) **A1**
(c) evaluates the integral between 6 and 7 for R_2 **M1**
(c) area of R_2 = 13/12 (the integral is -13/12, negative as the curve is below the axis) **A1**
(c) Answer: $R_1 = 144$, $R_2 = 13/12$
(d) adds the magnitudes of the two areas **M1**
(d) 1741/12 **A1**
(d) Answer: 1741/12

Question 6

(a) equates the expressions for y and rearranges to a quadratic **M1**
(a) x = 1 and x = 3 **A1**
(a) (1, 4) and (3, 14) **A1**
(a) Answer: A(1, 4), B(3, 14)
(b) area = integral of (line - curve) or of (curve - line) between the x values **M1**
(b) integrand $2x^2 - 8x + 6$ **A1**
(b) integrates and substitutes the limits **M1**
(b) 8/3 **A1**
(b) Answer: 8/3

Question 7

(a) raises each power by 1 and divides by the new power **M1**
(a) $(1/3)x^3$ **A1**
(a) $- 8x^{1/2} - x + C$ **A1**
(a) Answer: $(1/3)x^3 - 8x^{1/2} - x + C$
(b) F(4) - F(1) **M1**
(b) F(4) = 4/3 **A1**
(b) F(1) = -26/3, so the value is 10 **A1**
(b) Answer: 10

Question 8

(a) A/(x - p) + B/(x - q) and equating numerators **M1**
(a) A = -1 **A1**
(a) B = 2 **A1**
(a) Answer: -1/(x - 2) + 2/(x - 3)
(b) integrates each term to a logarithm: A ln|x - p| + B ln|x - q| **M1**
(b) -1 ln|x - 2| + 2 ln|x - 3| (+ c) **A1**
(b) substitutes the limits and combines logs **M1**
(b) -ln(5/2) + 2 ln(4) **A1**
(b) Answer: -ln(5/2) + 2 ln(4)

Question 9

(a) multiplies out two brackets **M1**

(a) $x^3 - 5x^2 + 6x$ (cso) **A1**

(a) Answer: $y = x^3 - 5x^2 + 6x$

(b) integrates term by term, raising each power by 1 **M1**

(b) $x^4/4 - 5/3x^3 + 3x^2$ (+ c) **A1**

(b) Answer: $(1/4)x^4 - (5/3)x^3 + 3x^2 + c$

(c) evaluates the integral between 0 and 2 for R_1 **M1**

(c) area of R_1 = 8/3 (the integral is 8/3) **A1**

(c) evaluates the integral between 2 and 3 for R_2 **M1**

(c) area of R_2 = 5/12 (the integral is -5/12, negative as the curve is below the axis) **A1**

(c) Answer: $R_1 = 8/3$, $R_2 = 5/12$

(d) adds the magnitudes of the two areas **M1**

(d) 37/12 **A1**

(d) Answer: 37/12

Question 10

(a) A/(x - p) + B/(x - q) and equating numerators **M1**

(a) A = 4 **A1**

(a) B = 2 **A1**

(a) Answer: 4/(x - 2) + 2/(x - 3)

(b) integrates each term to a logarithm: A ln|x - p| + B ln|x - q| **M1**

(b) 4 ln|x - 2| + 2 ln|x - 3| (+ c) **A1**

(b) substitutes the limits and combines logs **M1**

(b) 4 ln(5/2) + 2 ln(4) **A1**

(b) Answer: 4 ln(5/2) + 2 ln(4)

Question 11

(a) u = x, $dv/dx = e^{2x}$ so du/dx = 1 and $v = e^{2x}/2$ **M1**

(a) $x\,e^{2x}/2$ - integral of $e^{2x}/2$ dx **A1**

(a) $x\,e^{2x}/2 - e^{2x}/4 + c$ **A1**

(a) Answer: $x\,e^{2x}/2 - e^{2x}/4 + c$

(b) substitutes the limits **M1**

(b) $(e^2 + 1)/4$ **A1**

(b) Answer: $(e^2 + 1)/4$

Question 12

(a) integrate to $x^4/4 - 2x^2$ **M1**

(a) cso, substitute limits correctly to obtain -4 **A1**

(a) Answer: -4 (given, cso)

(b) correct explanation: $y = x^3 - 4x$ is negative (curve below the x-axis) for $0 < x < 2$, so the integral is negative **B1**

(b) area = 4 (square units) **B1**

(b) Answer: Area = 4 square units

(c) split the region at x = 2, using the root of $x^3 - 4x = 0$ **M1**

(c) find the definite integral from x = 2 to x = 3 **M1**

(c) value 6.25 (or 25/4) correct **A1**

(c) combine |-4| + 6.25, taking the absolute value of the negative part **M1**

(c) total area = 41/4 (or 10.25), cao **A1**

(c) Answer: 41/4 square units (10.25)

Question 13

(a) set $6x - x^2 = 2x$ and rearrange to form a quadratic in x **M1**

(a) solve by factorising to obtain x = 0 and x = 4 **M1**

(a) both coordinates (0, 0) and (4, 8) correct **A1**

(a) Answer: (0, 0) and (4, 8)

(b) form the difference (curve minus line) = $4x - x^2$ **M1**

(b) integrate to $2x^2 - x^3/3$ **M1**

(b) correct use of limits x = 0 and x = 4 **M1**

(b) 32/3 (or awrt 10.7), cao **A1**

(b) Answer: 32/3 square units (awrt 10.7)

Question 14

(a) substitute x = 1 into $\sqrt{1 + x^3}$ **M1**

(a) awrt 1.4142 **A1**

(a) Answer: 1.4142 (awrt)

(b) correct trapezium rule structure: (h/2)[(y0 + y4) + 2(y1 + y2 + y3)] **M1**

(b) correct substitution of h = 0.5 and all five table values **M1**

(b) awrt 3.28 **A1**

(b) Answer: 3.28 (awrt)

(c) overestimate **B1**

(c) correct reason: the curve is convex (concave up, gradient increasing) on this interval, so the trapezia lie above the curve **B1**

(c) Answer: Overestimate, since the curve is convex (concave up) over [0, 2], so each trapezium lies above the curve.

Question 15

$(1/4)x^4 + c$ cao **B1**

Answer: $(1/4)x^4 + c$

Question 16

$2x^2 - 3x + c$ cao **B1**

Answer: $2x^2 - 3x + c$

Question 17

(a) let u = 2x - 1, express x = (u+1)/2 and dx = du/2 **M1**

(a) substitute to obtain (1/4) integral of $(u^{3/2} + u^{1/2})$ du **M1**

(a) integrate to $(1/4)[(2/5)u^{5/2} + (2/3)u^{3/2}]$ **M1**

(a) simplify to $(1/10)u^{5/2} + (1/6)u^{3/2}$ (+c) **A1**

(a) substitute back u = 2x-1, cao **A1**

(a) Answer: $(1/10)(2x - 1)^{5/2} + (1/6)(2x - 1)^{3/2} + c$

(b) substitute x = 5 (u = 9) into their result from part (a) **M1**

(b) substitute x = 1 (u = 1) and subtract **M1**

(b) 428/15 oe (awrt 28.5), cao **A1**

(b) Answer: 428/15 (awrt 28.5)

Question 18

(a) rewrite $\sin^2(x)$ as $(1 - \cos 2x)/2$ **M1**

(a) integrate term by term **M1**

(a) $(1/2)x - (1/4)\sin(2x) + c$, cao **A1**

(a) Answer: $(1/2)x - (1/4)\sin(2x) + c$

(b) use identity $\cos^2(3x) = (1 + \cos 6x)/2$ **M1**

(b) integrate the constant term to $(1/2)x$ **M1**

(b) integrate the $\cos 6x$ term, dividing by 6 (chain rule factor) **M1**

(b) $(1/2)x + (1/12)\sin(6x) + c$, cao **A1**

(b) Answer: $(1/2)x + (1/12)\sin(6x) + c$

(c) substitute upper limit $x = \pi/6$, using $\sin(\pi) = 0$ **M1**

(c) substitute lower limit $x = 0$ **M1**

(c) $\pi/12$, cao **A1**

(c) Answer: $\pi/12$

Question 19

(a) choose $u = x$, $dv/dx = \sin(2x)$, correctly giving $du/dx = 1$ and $v = -(1/2)\cos(2x)$ **M1**

(a) apply the by-parts formula uv - integral of v du **M1**

(a) correct expression $-x/2\cos(2x) + (1/2)$ integral of $\cos(2x)$ dx **A1**

(a) integrate the remaining term to $(1/4)\sin(2x)$ **A1**

(a) $-(x/2)\cos(2x) + (1/4)\sin(2x) + c$, cao **A1**

(a) Answer: $-(x/2)\cos(2x) + (1/4)\sin(2x) + c$

(b) choose $u = \ln x$, $dv/dx = x^2$, correctly giving $du/dx = 1/x$ and $v = x^3/3$ **M1**

(b) apply the by-parts formula uv - integral of v du **M1**

(b) correct expression $(x^3/3)\ln x - (1/3)$ integral of x^2 dx **A1**

(b) integrate the remaining integral to $(1/9)x^3$ **M1**

(b) $(x^3/3)\ln x - (1/9)x^3 + c$, cao **A1**

(b) Answer: $(x^3/3)\ln(x) - (1/9)x^3 + c$

Question 20

$-x^{-1} + c$ cao, oe $-1/x + c$ **B1**

Answer: $-1/x + c$

Question 21

$(1/4)e^{4x} + c$ cao **B1**

Answer: $(1/4)e^{4x} + c$

Question 22

8 cao **B1**

Answer: 8

Question 23

$(2/3)x^{3/2} + c$ cao **B1**

Answer: $(2/3)x^{3/2} + c$

Question 24

$(1/2)\sin(2x) + c$ cao **B1**

Answer: $(1/2)\sin(2x) + c$

Question 25

integrates $3/x$ to $3\ln(x)$ **M1**

$3\ln(x) + 2e^x + c$ cao **A1**

Answer: $3\ln(x) + 2e^x + c$

Question 26

recognises the form $k(2x+5)^4$ and finds k by differentiating to check **M1**

$(1/8)(2x+5)^4 + c$ cao **A1**

Answer: $(1/8)(2x+5)^4 + c$

Question 27

recognises the form $-k*\cos(4x-1)$ and finds k using the chain rule **M1**

$-(1/4)\cos(4x-1) + c$ cao **A1**

Answer: $-(1/4)\cos(4x-1) + c$

Question 28

sets $8x - x^2 = 3x$ and solves to find $x = 0$ and $x = 5$ **M1**

sets up and integrates the area as the integral of $(5x - x^2)$ dx **M1**

125/6 cao, oe awrt 20.8 **A1**

Answer: Points (0,0) and (5,15); area = 125/6

Question 29

finds the roots $x = 0$ and $x = 4$, and recognises the curve is below the axis for $0 < x < 4$ **M1**

integrates the two regions separately, from 0 to 4 and from 4 to 6, taking the modulus of the first **M1**

64/3 cao, oe awrt 21.3 **A1**

Answer: Area = 64/3

Question 30

integrates each term, raising the power by 1 and dividing by the new power **M1**

$2x^3 - 8x^{1/2} + c$ cao, oe $2x^3 - 8\sqrt{x} + c$ **A1**

Answer: $2x^3 - 8\sqrt{x} + c$

Question 31

(a) $dx/dt = 2t$ **B1**

(a) Answer: $dx/dt = 2t$

(b) cso, $y = 3 - 3 = 0$ when $t = 3$ **B1**

(b) coordinates (9, 0) **B1**

(b) Answer: (9, 0)

(c) Area = integral, from t=0 to t=3, of $(3-t)(2t)$ dt, correct limits **M1**

(c) expand integrand to $6t - 2t^2$ **M1**

(c) integrate to $3t^2 - (2/3)t^3$ **M1**

(c) substitute limits $t = 3$ and $t = 0$ **M1**

(c) area = 9, cao **A1**

(c) Answer: 9 square units

(d) find Cartesian equation $y = 3 - \sqrt{x}$, using $t = \sqrt{x}$ **M1**

(d) set up integral, from $x = 0$ to $x = 9$, of $(3 - \sqrt{x})$ dx **M1**

(d) integrate to $3x - (2/3)x^{3/2}$ **M1**

(d) evaluate to 9, confirming part (c) **A1**

(d) Answer: Area = 9 (confirmed)

Question 32

substitutes $x = (u-1)/2$, $dx = (1/2)du$ to form $(1/4)$ times the integral of $(u-1)*u^{1/2}$ du **M1**

integrates to $(1/10)u^{5/2} - (1/6)u^{3/2} + c$ and substitutes the limits u=1 (x=0) and u=9 (x=4) **M1**

298/15 cao, oe awrt 19.9 **A1**

Answer: 298/15

Question 33

forms 7x - 16 = A(x-3) + B(x-2) and substitutes x=2 and x=3 (or compares coefficients)	**M1**
A = 2, B = 5 cao	**A1**
integrates to 2ln(x-2) + 5ln(x-3) + c and substitutes the limits 4 and 5	**M1**
k = 72 cao	**A1**

Answer: A = 2, B = 5; k = 72