13

$f(x) = \int (3x^2 - 16x + 11)\, dx$

$= x^3 - 8x^2 + 11x + C$

x y
(7, 0)

$0 = 7^3 - 8(7)^2 + 11(7) + C$

$0 = 343 - 392 + 77 + C$

$0 = 28 + C$

$-28 = C$

$f(x) = x^3 - 8x^2 + 11x - 28$

Question			Generic scheme	Illustrative scheme	Max mark
13.			•1 interpret information given	•1 $f'(x)=3x^2-16x+11$ or $f(x)=\int(3x^2-16x+11)\,dx$	5
			•2 integrate any two terms	•2 eg $\frac{3x^3}{3}-\frac{16x^2}{2}\ldots$	
			•3 complete integration	•3 $\ldots+11x+c$	
			•4 interpret information given and substitute	•4 $0=7^3-8\times7^2+11\times7+c$	
			•5 process for c and state expression for $f(x)$	•5 $f(x)=x^3-8x^2+11x-28$	

Notes:

1. For candidates who make no attempt to integrate to find $f(x)$ award 0/5.
2. Do not penalise the omission of $f(x)$ or dx or the appearance of $+c$ at •1.
3. If any two terms have been integrated correctly •1 may be implied by •2.
4. For candidates who omit $+c$, only •1 and •2 are available.
5. For candidates who differentiate **any** term, •3 •4 and •5 are not available.
6. Candidates must attempt to integrate both terms containing x for •4 and •5 to be available. See Candidate B.
7. Accept $y=x^3-8x^2+11x-28$ at •5 since $y=f(x)$ is defined in the question.
8. Candidates must simplify coefficients in **their** final line of working for the last mark available in that line of working to be awarded.

Commonly Observed Responses:

Candidate A - incomplete substitution		**Candidate B** - partial integration	
$f(x)=x^3-8x^2+11x+c$	•1 ✓ •2 ✓ •3 ✓	$f(x)=x^3-8x^2+11+c$	•1 ✓ •2 ✓ •3 ✗
$f(x)=7^3-8\times7^2+11\times7+c$	•4 ^	$0=7^3-8\times7^2+11+c$	•4 $\boxed{✓1}$
$c=-28$		$c=38$	
$f(x)=x^3-8x^2+11x-28$	•5 $\boxed{✓1}$	$f(x)=x^3-8x^2+49$	•5 $\boxed{✓1}$