13	16 a	The derivative of a function $f(x)$ is $f'(x) = 4x - 3$. The line $y = 5x - 7$ is tangent to the graph of $f(x)$. Find the function $f(x)$.	3

$f'(x) = 4x - 3$

$f(x) = 2x^2 - 3x + c$

$2x^2 - 3x + c = 5x - 7$

$2x^2 - 8x + c + 7 = 0$

If tangent, then $\Delta = 0$:

$\Delta = (-8)^2 - 4(2)(c + 7) = 0$

$64 - 8(c + 7) = 0$

$64 - 8c - 56 = 0$

$8 - 8c = 0$

$8c = 8$

$c = 1$

$\therefore f(x) = 2x^2 - 3x + 1$

OR: Gradient of tangent = 5

$\therefore 4x - 3 = 5$

$4x = 8$

$x = 2$

Subs in $y = 5x - 7$:

$y = 5(2) - 7$

$= 3$

$\therefore$ point of intersection (2, 3)

As $f'(x) = 4x - 3$

$f(x) = 2x^2 - 3x + c$

Subs (2, 3):

$3 = 2(2)^2 - 3(2) + c$

$3 = 8 - 6 + c$

$c = 1$

$\therefore f(x) = 2x^2 - 3x + 1$

State Mean: **1.58/3**

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by the Board of Studies

Board of Studies: Notes from the Marking Centre

Most candidates got at least one mark for finding the correct primitive or finding the point of contact of the tangent by solving $4x - 3 = 5$. Many candidates then used this to calculate the correct constant and receive full marks. Not as common, but still quite successful, was the method of using the discriminant of the equation $2x^2 - 3x + c = 5x - 7$ to get the correct value of the constant.

Source: http://www.boardofstudies.nsw.edu.au/hsc_exams/