12. $f'(x) = -4\cos\left(3x - \frac{\pi}{6}\right) \times 3$

$= -12\cos\left(3x - \frac{\pi}{6}\right)$

$f'\left(\frac{\pi}{6}\right) = -12\cos\left(3 \times \frac{\pi}{6} - \frac{\pi}{6}\right)$

$= -12\cos\left(\frac{2\pi}{6}\right)$

$= -12\cos\left(\frac{\pi}{3}\right)$

$= -12 \times \frac{1}{2}$

$= \underline{\underline{-6}}$

$\cos\frac{\pi}{3} = \cos 60 = \frac{1}{2}$

Question			Generic Scheme	Illustrative Scheme	Max Mark
12.			$\bullet^1$ start to differentiate $\bullet^2$ complete differentiation $\bullet^3$ evaluate derivative	$\bullet^1$ $4\cos\left(3x-\frac{\pi}{3}\right)\ldots$ $\bullet^2$ $\ldots\times 3$ $\bullet^3$ $6\sqrt{3}$	**3**

Notes:

1. Where candidates make no attempt to differentiate or use another invalid approach, $\bullet^2$ and $\bullet^3$ are not available.
2. At the $\bullet^1$ and $\bullet^2$ stage, candidates who work in degrees cannot gain $\bullet^1$. However $\bullet^2$ and $\bullet^3$ are still available.
3. At the $\bullet^3$ stage, do not penalise candidates who work in degrees or in radians and degrees.
4. Ignore the appearance of $+c$ at any stage.

Commonly Observed Responses:

Candidate A
Differentiating over two lines

$f'(x)=4\cos\left(3x-\frac{\pi}{3}\right)$ $\bullet^1$ ✓

$f'(x)=12\cos\left(3x-\frac{\pi}{3}\right)$ $\bullet^2$ ^

$6\sqrt{3}$ $\bullet^3$ ✓ 1

Candidate B

$4\cos\left(3x-\frac{\pi}{3}\right)\times\frac{1}{3}$ $\bullet^1$ ✓ $\bullet^2$ ✗

$\frac{2\sqrt{3}}{3}$ $\bullet^3$ ✓ 1

Candidate C

$4\cos\left(3x-\frac{\pi}{3}\right)$ $\bullet^1$ ✓ $\bullet^2$ ^

$2\sqrt{3}$ $\bullet^3$ ✓ 1

Candidate D

$\pm 12\sin\left(3x-\frac{\pi}{3}\right)$ $\bullet^1$ ✗

$\bullet^2$ ✗

± 6 $\bullet^3$ ✓ 1

Candidate E

$\pm 4\sin\left(3x-\frac{\pi}{3}\right)\ldots$ $\bullet^1$ ✗

$\ldots\times 3$ $\bullet^2$ ✓ 1

± 6 $\bullet^3$ ✓ 1

Candidate F

$-12\cos\left(3x-\frac{\pi}{3}\right)$ $\bullet^1$ ✗

$\bullet^2$ ✓

$-6\sqrt{3}$ $\bullet^3$ ✓ 1