7 (a) $-6x^2+24x-25$

$$= -6[x^2-4x]-25$$

$$= -6[(x-2)^2-4]-25$$

$$= -6(x-2)^2+24-25$$

$$= -6(x-2)^2-1$$

(b) $f(x) = -2x^3 + 12x^2 - 25x + 9$

$f'(x) = -6x^2 + 24x - 25$

$= -6(x-2)^2 - 1$

$(x-2)^2 \geqslant 0$ for all values of x,

therefore $-6(x-2)^2 - 1 < 0$ for all values of x;

therefore $f(x)$ is strictly decreasing for all $x \in R$.

Question			Generic scheme	Illustrative scheme	Max mark
7.	(a)		**Method 1** •1 identify common factor •2 complete the square •3 process for r and write in required form	**Method 1** •1 $-6\left(x^2-4x\ldots\right.$ stated or implied by •2 •2 $-6\left(x-2\right)^2\ldots$ •3 $-6\left(x-2\right)^2-1$	3
			Method 2 •1 expand completed square form •2 equate coefficients •3 process for q and r and write in required form	**Method 2** •1 $px^2+2pqx+pq^2+r$ •2 $p=-6$, $2pq=24$ $pq^2+r=-25$ •3 $-6\left(x-2\right)^2-1$	

Notes:

1. $-6\left(x-2\right)^2-1$ **with no working** gains •1 and •2 only. However, see Candidate E.
2. •3 is not available in cases where $p>0$.

Commonly Observed Responses:

Candidate A $-6\left(x^2-4\right)-25$ $-6\left(\left(x-2\right)^2-4\right)-25$ •1 ✓ •2 ✓ $-6\left(x-2\right)^2-1$ •3 ✓ See the exception to general marking principle (h)	**Candidate B** $px^2+2pqx+pq^2+r$ •1 ✓ $p=-6,\ 2pq=24,\ pq^2+r=-25$ •2 ✓ $q=-2,\ r=-1$ •3 ^ •3 is lost as answer is not in completed square form
Candidate C $-6\left(x^2+24x\right)-25$ •1 ✗ $-6\left(\left(x+12\right)^2-144\right)-25$ •2 $\boxed{\checkmark\ 1}$ $-6\left(x+12\right)^2+839$ •3 $\boxed{\checkmark\ 1}$	**Candidate D** $-6\left(\left(x+12\right)^2-144\right)-25$ •1 ^ •2 ✗ $-6\left(x+12\right)^2+839$ •3 $\boxed{\checkmark\ 1}$
Candidate E $-6\left(x-2\right)^2-1$ Check: $=-6\left(x^2-4x+4\right)-1$ $=-6x^2+24x-24-1$ $=-6x^2+24x-25$ Award 3/3	**Candidate F** $-6x^2+24x-25$ $=6x^2-24x+25$ •1 ✗ $=6\left(x^2-4x\ldots\right.$ $=6\left(x-2\right)^2\ldots$ •2 $\boxed{\checkmark\ 1}$ $=-6\left(x-2\right)^2\ldots$ •3 ✗

Question			Generic scheme	Illustrative scheme	Max mark
	(b)		**Method 1** •4 differentiate •5 link with (a) and identify sign of $(x-2)^2$ •6 communicate reason	**Method 1** •4 $-6x^2+24x-25$ •5 $f'(x)=-6(x-2)^2-1$ and $(x-2)^2\geq 0\ \forall x$ •6 eg $\therefore -6(x-2)^2-1<0\ \forall x$ $\Rightarrow$ always strictly decreasing	3
			Method 2 •4 differentiate •5 identify maximum value of $f'(x)$ •6 communicate reason	**Method 2** •4 $-6x^2+24x-25$ •5 'maximum value is -1' or annotated sketch including x-axis •6 $-1<0$ or 'graph lies below x-axis' $\therefore f'(x)<0\ \forall x$ $\Rightarrow$ always strictly decreasing	

Notes:

3. In Method 1, do not penalise $(x-2)^2>0$ or the omission of $f'(x)$ at •5.
4. In Method 1, accept $-6(x-2)^2\leq 0$ or $-6(x-2)^2<0$ at •5.
5. At •5 communication must be explicitly in terms of the derivative of the given function. Do not accept statements such as '$(\text{something})^2\geq 0$', 'something squared$\geq 0$'.
   However, •6 is still available.

Commonly Observed Responses:

Candidate G

$f'(x)=-6x^2+24x-25$	•4 ✓
$f'(x)=-6(x-2)^2-1$	•5 ^
$-6(x-2)^2-1<0$	
$\Rightarrow$ strictly decreasing	•6 ^