since exp is entire, we have that
domain of $h = \mathbb{C} - \{y : -3 \le y\}$

ii) $f(-1-2i) = \exp(i(-1-2i)-3)$
$= \exp(-i+2-3)$
$= \exp(-1-i)$
2A,M $= e^{-1}\cos 1 - ie^{-1}\sin 1$ ✓

$g(-1-2i) = \operatorname{Log}(i(-1-2i)-3)$
$= \operatorname{Log}(-1-i)$
$= \log|-1-i| + i\operatorname{Arg}(-1-i)$
1A $= \log(\sqrt{2}) - 3\pi i/4$ ✓

$h(-1-2i) = (iz-3)^{4i}$
$= \exp(4i \operatorname{Log}(iz-3))$
$= \exp(4i(\log(\sqrt{2}) - 3\pi/4))$ (from $g(-1-2i)$)
$= \exp(3\pi + 4i\log\sqrt{2})$
3A,M $= \exp(3\pi + i\log 4)$
$= e^{3\pi}\cos(\log 4) + ie^{3\pi}\sin(\log 4)$ ✓

iii) $f(z) = \exp(iz-3)$
f is not one-one ✓ For any z, put
$z_1 = z + 2\pi$
$\exp(i(z+2\pi)-3) = \exp(2\pi i + iz - 3)$
$= \exp(2\pi i)\exp(iz-3)$
$= \exp(iz-3)$
1A for $f(z+2\pi) = f(z)$ ✓
Hence we cannot assign a unique value z in the domain such that $f(z) = w$ for any w, so f has no inverse function ✓
2M

iv) $g(z) = \operatorname{Log}(iz-3)$, $z \in \mathbb{C} - \{iy : y \ge -3\}$ ✓
Suppose $g(z_1) = g(z_2)$
Then $\operatorname{Log}(iz_1-3) = \operatorname{Log}(iz_2-3)$
$\operatorname{Log}(z) = \log|z| + i\operatorname{Arg} z$
where $\operatorname{Arg} z \in (-\pi, \pi]$ so exp is one-one and
$\exp(\operatorname{Log}(iz_1-3)) = \exp(\operatorname{Log}(iz_2-3))$
$iz_1 - 3 = iz_2 - 3$
$iz_1 = iz_2$
$z_1 = z_2$
and g is one-one, hence has an inverse function.
$\operatorname{Log}(iz-3) = \log|iz-3| + i\operatorname{Arg}(iz-3) = x+iy$