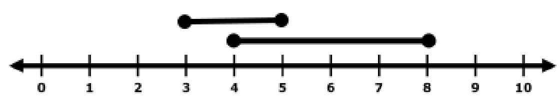
3. (a) $[a, b] = \{x \in \mathbb{R} \mid a \leq x \leq b\}$
$[c, d] = \{x \in \mathbb{R} \mid c \leq x \leq d\}$

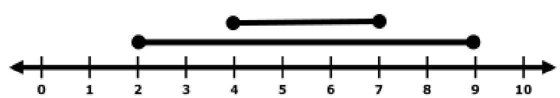
(b) Since $x \in [a, b]$, using the set build form above it can be converted to $a \leq x \leq b$. Then, simplify this statement into $x \leq b$. Using the premise of $b \leq d$, it is known that $x \leq b \leq d$. Once again, this can be simplified to $x \leq d$, resulting in the desired statement.

(c) Since $b \in [a, b]$, from the premise that $[a, b] \subseteq [c, d]$ and the fact that any element of a subset must also exist in the superset, it is known that $b \in [c, d]$. From the set build form above, this implies that $c \leq b \leq d$. This can be simplified to show that $b \leq d$, demonstrating the desired statement.

(d) 

(e) No, for example $3 \in [3, 5]$, but it's also the case that $3 \notin [4, 8]$. So by definition of a subset, there is an element that exists in $[3, 5]$ that doesn't exist in $[4, 8]$, so $[3, 5] \not\subseteq [4, 8]$.

(f) In this case $b \leq d$, but $a \not\leq c$.

(g) 

(h) Yes, as can be seen in the example above every element of $[4, 7]$ exists in $[2, 9]$.

(i) Since $[4, 7] \subseteq [2, 9]$, both statements should be true based on the proof above.