1.

a)

This Language is acceptable but not decidable because the only way to tell if the tape of M is bounded on w is to run M on w and check to see if it reaches a state where it can no longer access new tape spaces. This means it doesn't have to determain if M halts on w so it has a better chance of halting than M, since it only has to make sure that the possible transistions for M no longer bring it to a new space in the tape. However if M does not halt and it is constantly in a state where it can access new tape spaces then the machine that accepts L will not be able to halt, meaning it cannot be decidable.

b)

This Language is acceptable but not decidable because the only way to determain n is to simulate the machine M and then read the number of tape spaces used by M. Then it can check to make sure that the number of trailing ones is at most n. If the machine M hangs then this machine will also hang so it cannot always be decidable. It can however sometimes halt and return false.

2.

a)

this is not turing acceptable because with any given alphabet you can generate a infinite number of possible input strings mean the machine could never halt if you try to simulate M for every possible input.

b)

this is turing acceptable but not decidable because you can simulate M for every possible input string and run them in a dovetail mannor then as soon as at least 10 of the strings are accepted by M the machine would halt with $\rho(M)$ being in the language. If M hangs than it also hangs

c)

This is Turing decidable because you could simulate the first 10 steps of M and if it accepts w then its accepted otherwise its rejected.

d)

This is turing acceptable because it can simulate M on w and if M accepts w in less than 10 steps it rejects, but if M halts at 10 or more steps than it accepts, but if M hangs than it hangs as well.

3.

If a machine M exist that decides this language than we could use this machine to decide the language $\{\rho(M_1) : L(M_1) = \Sigma*\}$ the second machine M_2 would then have to be equal to $\Sigma*$ since there is no larger set. This would mean M would have to be able to decide a language that was proven to be undecidable in the Language book $L(M_1) = L(M_2)$

$$M \searrow \rho(M_1)\rho(M_2) \Leftrightarrow L(M_1) = L(M_2) \Leftrightarrow L(M) = \Sigma*$$