THE COMMON ION EFFECT

a) $SrSO_{4(s)} \rightleftharpoons Sr^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$

b) For every mole of strontium sulphate which dissolves, you will get 1 mole of Sr^{2+} ions and 1 mole of SO_4^{2-} ions.

If the concentration of strontium ions is s mol dm^{-3}, then

$[Sr^{2+}] = s \text{ mol } dm^{-3}$

$[SO_4^{2-}] = s \text{ mol } dm^{-3}$

$K_{sp} = [Sr^{2+}] [SO_4^{2-}] = s^2 = 3.2 \times 10^{-7} \text{ mol}^2 \text{ dm}^{-6}$

$s = 5.7 \times 10^{-4} \text{ mol dm}^{-3}$

c) $SrSO_{4(s)} \rightleftharpoons Sr^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$

According to Le Chatelier, adding more sulphate ions will shift the position of equilibrium to the left as the system moves to counter the change. That means that the concentration of strontium ions in solution will fall.

d) If the new concentration of strontium ions is s mol dm^{-3}, then

$[Sr^{2+}] = s \text{ mol } dm^{-3}$

$[SO_4^{2-}] = 0.50 \text{ mol } dm^{-3}$

(You are told that the total concentration of sulphate ions in the solution is 0.50 mol^{-3}, and so you don't have to worry about where those ions would be coming from.)

$K_{sp} = [Sr^{2+}] [SO_4^{2-}]$

$s \times 0.50 = 3.2 \times 10^{-7} \text{ mol}^2 \text{ dm}^{-6}$

$s = 6.4 \times 10^{-7} \text{ mol dm}^{-3}$

(You will see that that is consistent with your answer to part (c).)