Dave's 1pm Math Problem!

It all begins at 1pm! When will the angle between the minute and hour hands be 90^o (a right angle)?
Answer to nearest (whole number) second.

Some quick thoughts. At 1:20pm the angle between the two hands would be (if the hour hand did NOT move…) 90^o, but of course the hour hand does move a bit, so a right angle will be attained a little past 1:20pm.

Mathematic Solution using the 2 angular (as opposed to linear) position functions:
(Think $x = rt + x_o$ but we'll be using angular variables)
First the minute hand:
$\Theta_1 = \frac{\pi}{30}\,t$ (angular velocity, $\omega = 2\pi\ radians\ per\ 60min$, initially $\Theta_o = 0$ *radians)*
Next the hour hand:
$\Theta_2 = \frac{\pi}{360}\,t + \frac{\pi}{6}$ (angular velocity, $\omega = 2\pi\ radians\ per\ 12hr$, initially $\Theta_o = \frac{\pi}{6}$ *radians)*

So when will $\Theta_1 - \Theta_2 = \frac{\pi}{2}$ *radians* (90^o) ???

$\frac{\pi}{30}\,t - (\frac{\pi}{360}\,t + \frac{\pi}{6}) = \frac{\pi}{2}$ or $\frac{11\pi}{360}\,t = \frac{2\pi}{3}$ or $t = \frac{240}{11}$ minutes or 21.8181…

Just have to get .818181… minutes to the nearest second which is:
$\frac{81}{99}$ ~ 49 seconds!

So… **T = 21 minutes and 49 seconds** (to the nearest second)