I will see if I can type it here.

$$\frac{1}{1-\varepsilon} \approx 1+\varepsilon$$
$$\sqrt{1-\varepsilon} \approx 1-\varepsilon/2-\varepsilon^2/8$$

where ϵ is the ratio of the Schwarzschild radius over the radius of closest approach to the sun. Zee does at least the first approximation, and Brown (I think) did at least the second for the gravitational lensing.

Try to adopt Zee's notation for my integral for the Shapiro case – for just the earth-sun leg:

$$\Delta t = \int_{r_0}^{r_E} \frac{dr}{\left(dr/dt\right)}$$
$$= \frac{1}{c}\int_{r_0}^{r_E} \frac{rdr}{\left(r-r_s\right)\sqrt{1-\frac{r-r_s}{r^3}\left(\frac{r_0^3}{r_0-r_s}\right)}}$$

where (r_s) is the Schwarzschild radius of the sun, (r_0) is the closest approach to the sun, and (r_E) is the earth's distance from the sun. The quantity in the radical in the denominator goes to 0 at (r_0).

Maybe it would be simpler to note that if (dr/dt) goes to zero at closest approach to the sun, then (1/(dr/dt)) goes to infinity at closest approach?