Task 1 Trigonometric approximations deliverables

Deliverable 2

x	Values from C using mathematical library	Values from Cortex-M4	Values from Cortex-M4 (Hex)	Difference
0	0	0	0x0	0
π/20	0.156434	0.156434	0x3E203052	0
π/10	0.309017	0.309017	0x3E9E3774	0
3π/20	0.45399	0.453991	0x3EE87188	0.000006
π/5	0.587785	0.587792	0x3F167991	0.000007
π/4	0.707107	0.707143	0x3F35074C	0.00036
3π/10	0.809017	0.809146	0x3F4F2431	0.000129
7π/20	0.891007	0.891385	0x3F6431D3	0.000378
2π/5	0.951057	0.952017	0x3F73B75F	0.00096
9π/20	0.987688	0.989866	0x3F7D67E2	0.002178
π/2	1	1.00452	0x3F809445	0.00452

Deliverable 3

Highlighted shows the greatest difference.

The value of x with the greatest difference between the library value and from the Cortex-M4 is $\frac{\pi}{2}$.

Deliverable 4

$\frac{\pi}{2}$ has the greatest difference as it has the largest value on the table which would require a higher number of terms for the approximation to be closer to the true value.

Deliverable 5

$\sin(\frac{\pi}{2})$ must be accurate to no less than 4 decimal range, how many terms are required in the Taylor series?

Try 4 terms:

$$\sin(\frac{\pi}{2}) = \frac{\pi}{2} - \frac{\frac{\pi}{2}^3}{3!} + \frac{\frac{\pi}{2}^5}{5!} - \frac{\frac{\pi}{2}^7}{7!} = 1.570796 - 0.645964 + 0.079693 - 0.004682 = 0.999843 \approx 0.9998$$

Try 5 terms:

$$\sin(\frac{\pi}{2}) = \frac{\pi}{2} - \frac{\frac{\pi}{2}^3}{3!} + \frac{\frac{\pi}{2}^5}{5!} - \frac{\frac{\pi}{2}^7}{7!} + \frac{\frac{\pi}{2}^9}{9!} = 1.570796 - 0.645964 + 0.079693 - 0.004682 + 0.00016 = 1.000004 \approx 1.0000$$

5 terms of the Taylor series are needed to meet this specification.