Chap 0

9, 10, 11, 12, 13, 14, 18, 19

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9. $\cos(2x) = 1 - 2x^2 + 2x^4/3$. Maximum truncation error in $[-1,2]$ is 4.32131 at $x = 2$. From a plot of the errors, we see that the error is very small until $|x| \approx 0.673$ where the error is 0.016; it increases rapidly beyond this value for x.

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10. $\cos(2x) = \cos(2)/3*[2x^4 - 8x^3 + 6x^2 + 4x - 1] + \sin(2)/3*[4x^3 - 12x^2 + 6x + 2]$.
From a plot, we see that the error at $x = -1$ is about -7.20; at $x = 2$, about 0.19. The error is almost zero for $x \approx 0.43$ to 1.6; also near $x = 5.68$.

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11. a. 0.1234567E01.
b. -0.299999111E01.
c. 0.1325E-04
d. 0.123456789E09.
e. 0.2E-06.

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12. a. The difference in the fraction part is 2^{-24} times the largest exponent $(2^7) = 2^{-17}$.
b. The difference in the fraction part is 2^{-52} times the largest exponent $(2^{10}) = 2^{-42}$.

13* There are no values that you can enter from the keyboard that correspond to the inequalities. However, if ε is a value slightly less than eps, and if $X = Y = 1 + \varepsilon$ and Z is exactly 1, all inequalities hold.

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14. a. 19.1 when chopped; 19.1 when rounded; the answer is the same because of cancellations.
b. 19.0 when chopped; 19.1 when rounded.
c. Nested multiplication takes fewer operations: 6 versus 10. 19.0 when chopped; 19.1 when rounded.

18* $x + y = [1.14,2.65]$ Width is sum of widths.
$x - y + z = [2.22,7.18]$ Width is sum.
$x*z = [0,8.763]$ Width not obviously related.
$y/z = [-\infty,\infty]$ Zero is within both y and z.

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19. The next larger number in single precion floating-point will be 1.2345+2^(-24); the next smaller number is 1.2345-2^(-24). MATLAB gives these (in base 10, with 20 digits) as 1.2345000596046447061 and 1.2344999403953551553.

Exercises marked with an asterisk are "Selected Exercises" and answers are in the text.