MATH 753.01 - Fall 2020
Homework 01

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Section 0.4

Ex 1

Identify which values of x that there is subtraction of nearly equal numbers - Find an equivalent expression.

- (a)
$$\frac{1-\sec(x)}{\tan^2(x)} \tag{1}$$
The $\sec(x)$ function is very near $+1$ for values of $x \approx 2n\pi$, this would create subtraction of nearly equal numbers. We can use trigonometric rules:
$$\frac{1-1/\cos(x)}{\tan^2(x)} = \tag{2}$$

- (b)
$$\frac{1-(1-x)^3}{x} \tag{3}$$
For $x \approx 0$, the numerator evaluated roughly to $1-1$, thus we have subtraction of nearly equal numbers. Additionally, this would likely raise a *zero-division error* if $x = 0$ exactly. We can expand the numerator, and find the algebraic equivalent:
$$\frac{1-(-x^3+3x^2-3x+1)}{x} = \frac{x^3-3x^2+3x}{x} = x^2-3x+3 \tag{4}$$

- (c)
$$\frac{1}{1+x} - \frac{1}{1-x} \tag{5}$$
For $x \approx 0$, both terms will evaluate to approximately $1/1$. This would create subtraction of nearly equal numbers.

Ex 2

Find the roots of $x^2 + 3x - 8^{-14} = 0$ with three-digit accuracy.

Ex 4

Evaluate $x\sqrt{x^2+17} - x^2$ where $x = 9^{10}$ to three decimals.

We multiply the function by it's conjugate:

$$x\sqrt{x^2+17} - x^2 = \frac{(x\sqrt{x^2+17} - x^2)}{1}\frac{(x\sqrt{x^2+17} + x^2)}{(x\sqrt{x^2+17} + x^2)} = \frac{(x^2(x^2+17) - x^4)}{(x\sqrt{x^2+17} + x^2)} \tag{6}$$

0.5

Ex 4

Ex 6

Ex 8

Ex 9

1.1

Ex 2

Ex 4