

# Transcomputation - Exercise 2

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## 1 Simplify the following transarithmetical expressions to show that each relation evaluates true

### 1.1 Example

Expression:

$$\infty(3 - 2) \neq 3\infty - 2\infty$$

Simplification:

$$\infty(3 - 2) \neq 3\infty - 2\infty$$

$$\infty(1) \neq \infty - \infty$$

$$\infty \neq \Phi$$

### 1.2 Questions

1.2.1  $\infty(3 - 3) = 3\infty - 3\infty$

1.2.2  $\infty(2 + \Phi) = 2\infty + \infty\Phi$

1.2.3  $\Phi(3 - 2) = 3\Phi - 2\Phi$

1.2.4  $2(\infty + 3) = 2\infty + 2 \times 3$

## 2 Expand the following transarithmetical expressions and say whether each relation evaluates true or else false

### 2.1 Note

The transreal exponential,  $e^x$ , has  $e^{-\infty} = 0$ ,  $e^0 = 1$ ,  $e^\infty = \infty$ ,  $e^\Phi = \Phi$ . The transreal, natural logarithm,  $\ln y$ , is the inverse of the transreal exponential,  $e^x$ .

## 2.2 Example

Expression:

$$0^\infty = 0$$

Expansion:

$$0^\infty = e^{\ln 0^\infty} = e^{\infty \ln 0} = e^{\infty \times (-\infty)} = e^{-\infty} = 0. \text{ Therefore true.}$$

## 2.3 Questions

2.3.1  $1^\infty = 1^2$

2.3.2  $1^1 > 0^0$

2.3.3  $\Phi^\Phi \neq 1^\Phi$

2.3.4  $\infty^\infty = \infty$

## 3 Evaluate the following power series at

$$x = -\infty, \Phi, \infty$$

### 3.1 Example

Power Series:

$$e^x = \begin{cases} 1/e^{-x} & : x < 0 \\ 1 + \frac{x^1}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots & : \text{otherwise} \end{cases}$$

Evaluation:

$$\begin{aligned} e^\infty &= 1 + \frac{\infty^1}{1!} + \frac{\infty^2}{2!} + \frac{\infty^3}{3!} + \dots \\ &= 1 + \frac{\infty}{1!} + \frac{\infty}{2!} + \frac{\infty}{3!} + \dots \\ &= 1 + \infty + \infty + \infty + \dots \\ &= 1 + \infty \\ &= \infty \end{aligned}$$

$$\begin{aligned} e^{-\infty} &= 1/e^\infty \\ &= 1/\infty \\ &= 0 \end{aligned}$$

$$\begin{aligned} e^\Phi &= 1 + \frac{\Phi^1}{1!} + \frac{\Phi^2}{2!} + \frac{\Phi^3}{3!} + \dots \\ &= 1 + \frac{\Phi}{1!} + \frac{\Phi}{2!} + \frac{\Phi}{3!} + \dots \\ &= 1 + \Phi + \Phi + \Phi + \dots \\ &= 1 + \Phi \\ &= \Phi \end{aligned}$$

### 3.2 Questions

3.2.1  $\sin x = \frac{x^1}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$

3.2.1  $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$

## 4 Sketch the following graphs

### 4.1 Example $f(x) = x$

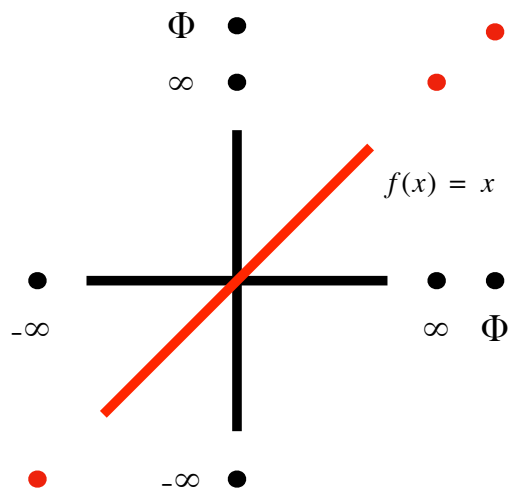


Figure 1:  $f(x) = x$

### 4.2 Questions

4.2.1  $e^x$

4.2.2  $\ln x$

4.2.3  $\sin x$

4.2.4  $\cos x$

4.2.5  $\tan x$

4.2.6  $\cos^2 x + \sin^2 x = 1^x$