Exponentials

Study Development Worksheet

Example

Simplify:

$$e^x \times e^y = 14e^{-x}$$

Answer

Simplify the left-hand side using index laws:

$$e^{x+y} = 14e^{-x}$$

Divide both sides by e^{-x}:

$$\frac{e^{x+y}}{e^{-x}} = 14$$

Then, use index laws again to simplify the left-hand side:

$$e^{x+y-(-x)} = 14$$

$$e^{2x+y} = 14.$$

Questions

1. Simplify:
   a. $e^2 \times e^{-1}$
   b. $e^a + e^b e^c$
   c. $\frac{e^t e^r}{e^s}$
   d. $e^d - e^f$
2. Solve for x:
   a. $e^x = 10$
   b. $x = e^{10} + e^{-1}$
   c. $\frac{e^{2x}}{e^{3x}} = 4$
   d. $log(x) = 12$

3. Differentiate:
   a. $f(x) = e^x$
   b. $f(x) = e^{2x} + e^{-x}$
   c. $f(x) = e^{x^2 + 6x}$
   d. $f(x) = \frac{e^{x^2}}{e^{3x^2 + 2}}$
   e. $f(x) = e^{x + log(x)}$

Answers

1. Using index laws:
   a. $e^2 \times e^{-1} = e^{2-1} = e^1$

   b. $e^a + e^b e^c = e^a + e^{b+c}$

   c. $\frac{e^t e^r}{e^s} = \frac{e^{t+r}}{e^s} = e^{t+r-s}$

   d. $e^d - e^f$ cannot be simplified any further

2. Using index laws and logarithms:
   a. $log(e^x) = log(10)$
      $x = log(10) = 2.30259$

   b. $x = 22026.834$

   c. $\frac{e^{2x}}{e^{3x}} = e^{2x-3x} = e^{-x} = 4$
      $log(e^{-x}) = log(4)$
      $-x = log(4)$
      $x = -log(4) = -1.3863$

   d. $e^{log(x)} = e^{12}$
      $x = e^{12} = 162754.791$

3. Using the fact that $\frac{\mathrm{d}(e^{ax})}{\mathrm{d}x} = a'e^{ax}$:
   a. $f'(x) = e^x$
   b. $f'(x) = 2e^{2x} - e^{-x}$
   c. $f'(x) = (2x + 6)e^{x^2 + 6x}$
   d. $f(x) = e^{x^2-(3x^2+2)} = e^{-2x^2-2}$
      $f'(x) = -4xe^{-2x^2-2}$
   e. $f'(x) = \left(1 + \frac{1}{x}\right)e^{x+log(x)}$

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