

Section 5.1Exponential function

$$f(x) = b^x$$

b positive, $b \neq 1$

base b , exponent x

domain: all real numbers

$$\text{Ex } f(x) = 2^x$$

$$f(-2) = 2^{-2} = \frac{1}{2^2} = \frac{1}{4}$$

$$f(0) = 2^0 = 1$$

$$f(3) = 2^3 = 8$$

properties

$$\bullet b^x b^y = b^{x+y}$$

$$\bullet (ab)^x = a^x b^x$$

$$\bullet \frac{b^x}{b^y} = b^{x-y}$$

$$\bullet \left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$$

$$\bullet (b^x)^y = b^{xy}$$

EX

$$16^{7/4} \cdot 16^{-4/2} = 16^{7/4 - 4/2} = 16^{5/4}$$

$$= (\sqrt[4]{16})^5 = 2^5 = 32$$

EX

find x such that $f(x) = 16$
 if $f(x) = 2^{2x-1}$

$$16 = 2^{2x-1} = 2^4$$

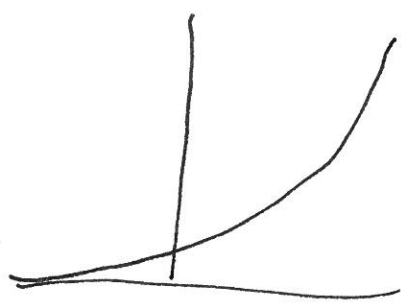


$$2^{2x-1} = 2^4$$

$$2x-1 = 4$$

$$2x = 5$$

$$x = 5/2$$

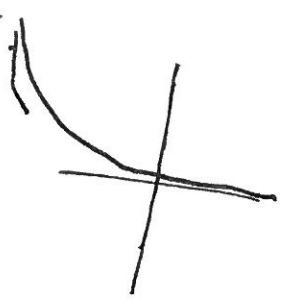


EX

graph $f(x) = 2^x$

EX

graph $f(x) = (1/2)^x = 2^{-x}$



EX) evaluate

$$* 3^{1/4} \cdot 9^{-5/8} = 3^{1/4} (3^2)^{-5/8} = 3^{1/4} 3^{2 \cdot (-5/8)} = 3^{1/4} \cdot 3^{-5/4}$$

$$= 3^{1/4 - 5/4} = 3^{-4/4} = 3^{-1} = 1/3$$

$$* \frac{4^{2.7} \cdot 4^{-1.3}}{4^{-0.4}} = 4^{2.7 - 1.3 - (-0.4)} = 4^{2.7 - 1.3 + 0.4}$$

$$= 4^{1.8} \text{ calculator}$$

EX) simplify

$$* (64x^9)^{1/3} = 64^{1/3} (x^9)^{1/3} = \sqrt[3]{64} x^{9 \cdot 1/3}$$

$$= 4x^3$$

$$* (2x^3y^2)^3 = 2^3 (x^3)^3 (y^2)^3 = 8x^9y^6$$

EX) solve for x

$$* 8^x = \left(\frac{1}{32}\right)^{x-2} \Rightarrow (2^3)^x = (2^{-5})^{x-2} \Rightarrow 2^{3x} = 2^{-5x+10}$$

$$3x = -5x + 10 \Rightarrow 8x = 10 \Rightarrow x = 10/8 = 5/4$$

$$* 2^{2x} - 4 \cdot 2^x + 4 = 0 \quad \text{let } u = 2^x$$

$$(2^x)^2 - 4 \cdot (2^x) + 4 = 0$$

$$u^2 - 4u + 4 = 0$$

$$(u-2)^2 = 0 \quad u = 2 \quad 2^x = 2^1 \quad x = 1$$

