

Section 5.1 Exponential Functions Solutions.

4. $(\sqrt{2}^{\sqrt{2}})^{\sqrt{2}} = (\sqrt{2})^2 = 2$ 6. $(3^{2+\sqrt{5}})(3^{2-\sqrt{5}}) = 3^{2+\sqrt{5}+2-\sqrt{5}} = 3^4 = 81$

8. $\frac{10^{\pi+2}}{10^{\pi-2}} = 10^{\pi+2-(\pi-2)} = 10^4 = 10,000$ 10. $(\sqrt{3}^{\pi})^4 = \sqrt{3}^{4\pi} = 9^{\pi}$

12. a) $2^x = 32 \Rightarrow x = 5$ b) $2^t = \frac{1}{4} \Rightarrow t = -2$ c) $2^{3y+1} = \sqrt{2} \Rightarrow 2^{3y+1} = 2^{1/2}$

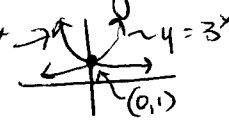
$\Rightarrow 3y+1 = 1/2 \Rightarrow 3y = -1/2 \Rightarrow y = -1/6$

d) $8^{z+1} = 32\sqrt{2} \Rightarrow 2^{3(z+1)} = 2^5 \cdot 2^{1/2} \Rightarrow 2^{3z+3} = 2^{5.5} \Rightarrow 3z+3 = 5.5$

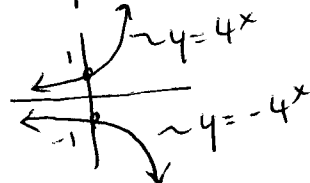
$\Rightarrow z = \frac{5.5-3}{3} = \frac{2.5}{3} = 5/6$

13. $y = 2^x$ D: all reals 14. $y = 2^x = 2^{-x}$ D: all reals

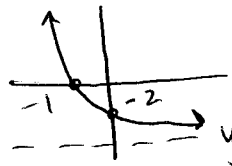
15. $y = \frac{1}{2^{x-1}}$ D: all reals 16. $y = \frac{1}{2^x - 1}$ D: all reals except $x=0$ ($2^0=1$)

18/22 $y = 3^x$ and $y = 3^{-x} = (\frac{1}{3})^x$ 

20. $y = 4^x$
 $y = -4^x$



28. $y = 3^{-x} - 3$



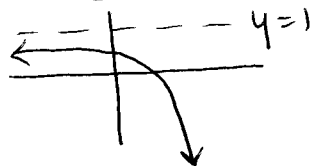
D: all reals

R: $y > -3$

x-int $(-1, 0)$

y-intercept $(0, -2)$
hor. asympt $y = -3$

32. $y = 1 - 3^{x-1}$



D: all reals

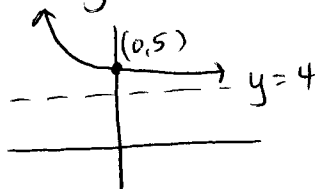
R: $y < 1$

x-int $(1, 0)$

y-int $(0, 2/3)$

HA $y = 1$

36. $y = 4 + (\frac{1}{4})^x$



D: all reals

R: $y > 4$

x-int. none

y-int $(0, 5)$

HA $y = 4$

40. $4x^2(2^x) - 9(2^x) = 0$

$2^x(4x^2 - 9) = 0$

$2^x(2x-3)(2x+3) = 0$

$x = 3/2, -3/2$ ($2^x \neq 0$)

39. $3x(10^x) + 10^x = 0$

$10^x(3x+1) = 0$

$10^x \neq 0$

$3x+1 = 0 \Rightarrow x = -1/3$

41. $3(3^x) - 5x(3^x) + 2x^2(3^x) = 0$

$3^x(3 - 5x + 2x^2) = 0$

$3^x(2x-3)(x-1) = 0$

$x = 3/2, 1$

42. $\frac{(x+4)10^x}{x-3} = 2x(10^x)$

$\Rightarrow (x+4)(10^x) = 2x(x-3)(10^x) \Rightarrow (x+4)(10^x) - (2x^2-6x)(10^x) = 0$

$\Rightarrow 10^x(x+4-2x^2+6x) = 0 \Rightarrow -10^x(2x^2-7x-4) = 0 \Rightarrow$

$-10^x(2x+1)(x-4) = 0 \quad x = -1/2 \quad x = 4$

44. $g(x) = x^4$ $h(x) = 3^x$ $[0, 5]$ $g(0) = 0$ $h(0) = 1$
 $g(5) = 625$ $h(5) = 243$
 Avg ROC_g $\frac{625}{5} = 125$ Avg ROC_h $= \frac{243-1}{5} = 48.4$ $\frac{125}{48.4} = 2.58$

So $g(x)$ Avg ROC is ≈ 2.5 times larger

$[5, 10]$ $g(5) = 625$ $h(5) = 243$ AROC $\frac{10,000-625}{5} = 1875$ AROC =
 $g(10) = 10,000$ $h(10) = 59049$ 11761.2

$\frac{11761.2}{1875} = 6.25$ so AROC of $h(x)$ is more than 6 times greater.

$[10, 15]$ $g(10) = 10,000$ $h(10) = 59049$ AROC $\frac{50625-10,000}{5} = 8135$ $h(15) = 14348907$
 $g(15) = 50625$ AROC = 2857971.6

$\frac{2857971.6}{8135} \approx 350.31$ so AROC of $h(x)$ is more than 350 times greater.

45. $f(x) = 2^x$ Show $\frac{f(x+h) - f(x)}{h} = 2^x \left(\frac{2^h - 1}{h} \right)$

$\frac{2^{x+h} - 2^x}{h} = \frac{2^x 2^h - 2^x}{h} = \frac{2^x(2^h - 1)}{h}$

46. $\phi(t) = 1 + a^t$ $\frac{1}{\phi(t)} + \frac{1}{\phi(-t)} = \frac{1}{1+a^t} + \frac{1}{1+a^{-t}} = \frac{1+a^{-t} + 1+a^t}{(1+a^t)(1+a^{-t})}$
 $= \frac{2+a^{-t}+a^t}{1+a^{-t}+a^t+1} = \frac{2+a^{-t}+a^t}{2+a^{-t}+a^t} = 1$

48. $S(x) = \frac{2^x - 2^{-x}}{2}$ $C(x) = \frac{2^x + 2^{-x}}{2}$ $[C(x)]^2 - [S(x)]^2 = \left(\frac{2^x + 2^{-x}}{2} \right)^2 - \left(\frac{2^x - 2^{-x}}{2} \right)^2$
 $= \frac{2^{2x} + 2 + 2^{-2x}}{4} - \frac{2^{2x} - 2 + 2^{-2x}}{4} = \frac{4}{4} = 1$

52. $\sqrt[5]{8} = 8^{1/5} = 2^{3/5} = 2^{.6} \approx 1.5$ calc $\sqrt[5]{8} \approx 1.52$

59. $10^x = 5$ $x \approx 0.7$ (from graph) 

64.

x	1	2	3	4	5	6	7	8	9	10
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Exponent to which 10 must be raised to yield x
 0 .3 .42 .58 .7 .78 .82 .9 .95 1