Precalculus Unit 4 Homework—Exponential and Logistic Functions

In exercises 1-6, determine which are exponential functions. For those that are, state the initial value and the base. For those that are not, explain why not.

1. $y = x^8$ no
2. $y = 3^x$ yes
3. $y = 5^x$ yes
4. $y = 4^2$ no
5. $y = x^{\sqrt{x}}$ no
6. $y = x^{1.3}$ no

In exercises 7-10, compute the exact value of the function for the given x-value without using a calculator.

7. $f(x) = 3 \cdot 5^x$ for $x = 0$ 3
8. $f(x) = 6 \cdot 3^x$ for $x = -2$ $\frac{2}{3}$
9. $f(x) = -2 \cdot 3^x$ for $x = \frac{1}{3}$ $-2\sqrt[3]{3}$
10. $f(x) = 8 \cdot 4^x$ for $x = -\frac{3}{2}$ 1

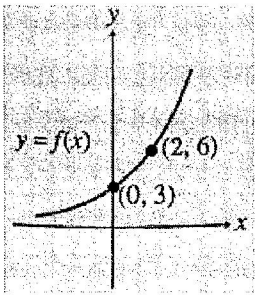
In exercises 11-12, determine a formula for the exponential function whose values are given in the table.

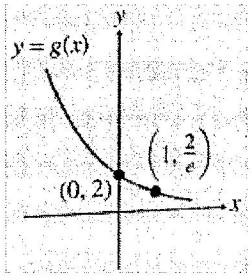
x	$f(x)$	$g(x)$
-2	6	108
-1	3	36
0	3/2	12
1	3/4	4
2	3/8	4/3

11. $f(x) = \frac{3}{2}\left(\frac{1}{2}\right)^x$
12. $g(x) = 12\left(\frac{1}{3}\right)^x$

In exercises 13-14, determine a formula for the exponential function whose graph is shown in the figure.

13. $f(x) = 3 \cdot \sqrt{2}^x$
14. $g(x) = 2 \cdot \left(\frac{1}{e}\right)^x$





In exercises 15-24, describe how to transform the graph of f into the graph of g. ~~Sketch the graph by hand. Use a calculator to check your answer.~~

15. $f(x)=2^x$, $g(x)=2^{x-3}$

16. $f(x)=3^x$, $g(x)=3^{x+4}$

17. $f(x)=4^x$, $g(x)=4^{-x}$

18. $f(x)=2^x$, $g(x)=2^{5-x}$

19. $f(x)=0.5^x$, $g(x)=3\cdot 0.5^x+4$

20. $f(x)=0.6^x$, $g(x)=2\cdot 0.6^{3x}$

21. $f(x)=e^x$, $g(x)=e^{-2x}$

22. $f(x)=e^x$, $g(x)=-e^{-3x}$

23. $f(x)=e^x$, $g(x)=2e^{3-3x}$

24. $f(x)=e^x$, $g(x)=3e^{2x}-1$

In exercises 25-30, match the given function with its graph. Explain how to make the choice without using a calculator.

25. $y=3^x$

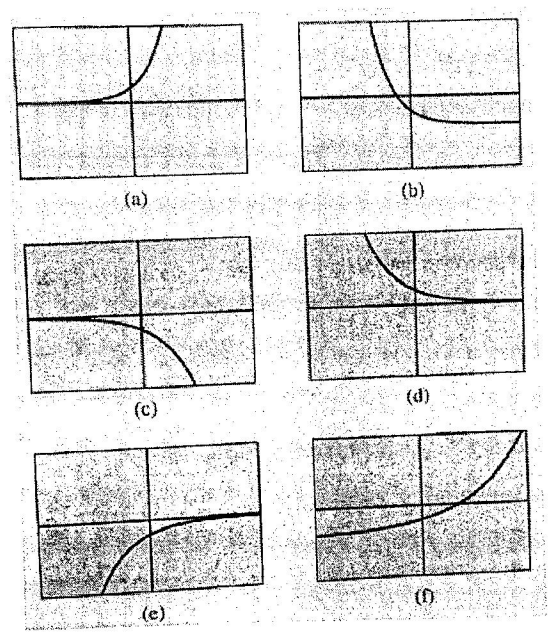
26. $y=2^{-x}$

27. $y=-2^x$

28. $y=-0.5^x$

29. $y=3^{-x}$ -2

30. $y=1.5^x$ -2



In exercises 31-34, state whether the function is an exponential growth function or exponential decay function. Describe its end behavior using limits.

31. $f(x)=3^{-2x}$

32. $f(x)=\left(\frac{1}{e}\right)^x$

33. $f(x)=0.5^x$

34. $f(x)=0.75^{-x}$

In exercises 35-38, use a calculator to graph the function. Find the y-intercept and the horizontal asymptotes.

35. $f(x)=\dfrac{12}{1+2\cdot 0.8^x}$

36. $f(x)=\dfrac{18}{1+5\cdot 0.2^x}$

37. $f(x)=\dfrac{16}{1+3e^{-2x}}$

38. $f(x)=\dfrac{9}{1+2e^{-x}}$

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HW – Exponential & Logistic Functions

1. no – x is not an exponent
2. yes $a=1$ $b=3$
3. yes $a=1$ $b=5$
4. no $y=4^2=16$ is a constant function
5. no x is a base
6. no x is a base
7. $f(0)=3\cdot 5^0=3\cdot 1=3$
8. $f(-2)=6\cdot 3^{-2}=6\cdot\frac{1}{9}=\frac{2}{3}$
9. $f(\frac{1}{3})=-2\cdot 3^{\frac{1}{3}}=-2\sqrt[3]{3}$
10. $f(-\frac{3}{2})=8\cdot 4^{-3/2}=8\cdot\frac{1}{4^{3/2}}=8\cdot\frac{1}{8}=1$
11. $f(x)=\frac{3}{2}\cdot(\frac{1}{2})^x$
12. $g(x)=12\cdot(\frac{1}{3})^x$
13. $f(x)=3\cdot\sqrt{2}^x$
14. $g(x)=2\cdot(\frac{1}{e})^x$
15. shift rt. 3
16. Shift left 4

17. reflect over y-axis

18. $g(x) = 2^{-x+5} = 2^{-(x-5)}$
shift right 5
reflect over y-axis

19. vertical stretch $*3$
shift up 4

20. horiz. shrink $*\frac{1}{3}$
vertical stretch $*2$

21. horiz. shrink $*\frac{1}{2}$
reflect over y-axis

22. horiz shrink $*\frac{1}{3}$
reflect over y-axis
reflect over x-axis

23. $g(x) = 2e^{-3x+3} = 2e^{-3(x-1)}$
shift right 1
horiz shrink $*\frac{1}{3}$
reflect over y-axis
vert. stretch $*2$

24. horiz. shrink $*\frac{1}{2}$
vert. stretch $*3$
shift down 1

25. a
26. d
27. c
28. e
29. b
30. f

31. $f(x) = 3^{-2x} = \left(\frac{1}{9}\right)^x$

decay $b = \frac{1}{9}$

$\lim_{x \to -\infty} f(x) = \infty$

$\lim_{x \to \infty} f(x) = 0$

32. $f(x) = \left(\frac{1}{e}\right)^x$

decay $b = \frac{1}{e}$

$\lim_{x \to -\infty} f(x) = \infty$

$\lim_{x \to \infty} f(x) = 0$

33. $f(x) = 0.5^x$

decay $b = 0.5$

$\lim_{x \to -\infty} f(x) = \infty$

$\lim_{x \to \infty} f(x) = 0$

34. $f(x) = 0.75^{-x} = \left(\frac{3}{4}\right)^{-x} = \left(\frac{4}{3}\right)^x$

growth $b = \frac{4}{3}$

$\lim_{x \to -\infty} f(x) = 0$

$\lim_{x \to \infty} f(x) = \infty$

35. y-int. $(0, 4)$

H.A. $y = 0$

$y = 12$

36. y-int $(0, 3)$

H.A. $y = 0$

$y = 18$

37. y-int $(0, 4)$

H.A. $y = 0$

$y = 16$

38. y-int $(0, 3)$

H.A. $y = 0$

$y = 9$