Noble Educators | Noble Learners

Name: _____
Date: _____ Class: Math 3 Honors, per: _____

Exponential Functions Worksheet & Review

Objective: I can analyze key features of exponential functions from equations, including domain, range, growth or decay, transformations, horizontal asymptote, intercepts, monotonicity, and end behavior.

For Questions 1–8, analyze each function completely. Include: domain, range, growth/decay factor, transformations from the parent exponential, horizontal asymptote, x-intercept, y-intercept, increasing/decreasing interval, and end behavior.

1. $f(x) = 2^x$	**2.** $g(x) = 3 \cdot 2^{x-1} + 4$
3. $h(x) = -2\left(\frac{1}{3}\right)^{x+2} - 1$	**4.** $p(x) = 4\left(\frac{1}{2}\right)^{x-3} + 5$
5. $r(x) = -3\left(\frac{1}{4}\right)^{x+1} + 6$	**6.** $s(x) = 5e^{0.4x} - 7$
7. $t(x) = 10e^{-0.2(x-1)} + 3$	**8.** $u(x) = \frac{1}{2} \cdot 4^{x+2} - 6$

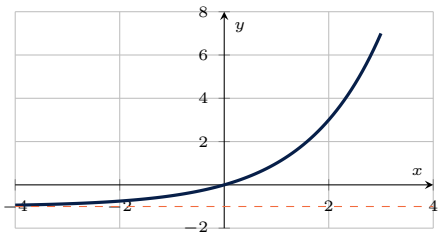
Noble Educators | Noble Learners

Name: _____
Date: _____ Class: Math 3 Honors, per: _____

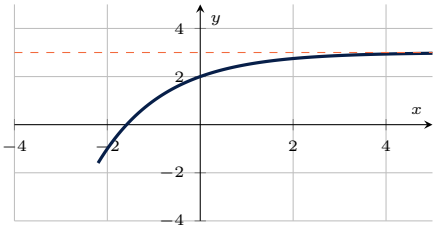
Exponential Functions Worksheet & Review

Objective: I can interpret exponential functions from graphs and tables and connect representations to equations.

9. Use the graph below to identify the domain, range, asymptote, intercepts, and whether the function is increasing or decreasing.



10. Use the graph below to identify the domain, range, asymptote, intercepts, and whether the function is increasing or decreasing.



11. Use the table to write an exponential equation and identify the growth factor, y-intercept, and horizontal asymptote.

x	-1	0	1	2
y	$\frac{4}{3}$	4	12	36

12. Use the table to write an exponential equation and identify the decay factor, horizontal asymptote, range, and y-intercept.

x	0	1	2	3
y	90	50	30	20

Objective: I can write and transform exponential functions using equations, descriptions, tables, and key features.

13. Describe the transformations of each function:
(a) $y = 2^{x-3} + 5$
(b) $y = -4 \cdot 3^{x+1} - 2$
(c) $y = 0.25(0.6)^x + 7$

14. Write the equation of an exponential function with base 2 that is reflected over the x-axis, shifted right 4, and shifted up 6.

15. Write an equation for an exponential function with horizontal asymptote $y = -3$ that passes through $(0, -1)$ and $(1, 1)$.

16. Write an equation for an exponential function with horizontal asymptote $y = 5$ that passes through $(0, 1)$ and $(1, -3)$.

Name: _____
Date: _____ Class: Math 3 Honors, per: _____

Exponential Functions Worksheet & Review

Objective: I can compare exponential functions with other function types and measure exponential change over intervals.

17. Classify each table as linear or exponential and explain using differences or ratios.

x	0	1	2	3
$A(x)$	5	10	20	40
$B(x)$	5	10	15	20

18. For $f(x) = 3^x$, find the average rate of change on $[0, 2]$ and on $[2, 4]$. Explain why this shows exponential growth is not linear.

19. If $f(x) = 3^x$ and $g(x) = x - 2$, find $(f \circ g)(x)$ and $(g \circ f)(x)$.

20. Find the inverse of $f(x) = 2^{x-1} + 3$. State the domain of f^{-1}.

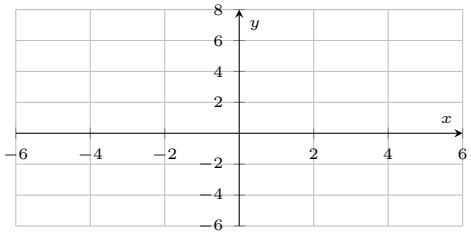
Noble Educators | Noble Learners

Name: _____
Date: _____ Class: Math 3 Honors, per: _____

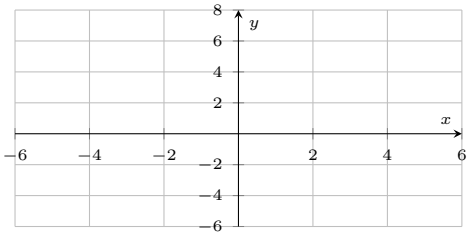
Exponential Functions Worksheet & Review

Objective: I can graph exponential functions and identify their key features from a sketch or plotted graph.

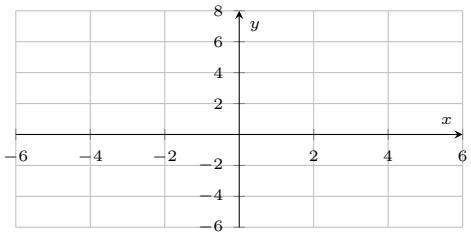
21. Sketch $f(x) = 2^{x+1} - 4$. Label at least three points, the horizontal asymptote, the x-intercept, and the y-intercept.



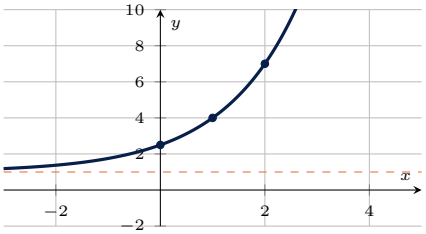
22. Sketch $g(x) = -3\left(\frac{1}{2}\right)^{x-2} + 1$. Label the horizontal asymptote, the x-intercept, the y-intercept, and the increasing/decreasing interval.



23. Sketch $h(x) = 4e^{-0.5x} + 2$. State the domain, range, horizontal asymptote, and y-intercept.



24. Use the graph to write a possible equation. Then state its asymptote and y-intercept.



Noble Educators | Noble Learners

Name: _____
Date: _____ Class: Math 3 Honors, per: _____

Exponential Functions Worksheet & Review

Objective: I can model exponential growth and decay using rates, multipliers, compound interest, half-life, and doubling time.

25. An exponential function has horizontal asymptote $y = -2$, y-intercept 1, and growth factor 3. Write the equation.	**26.** For $A(t) = 120(1.08)^t$, identify the initial value, multiplier, percent growth rate, and $A(5)$.
27. For $B(t) = 600(0.72)^t$, identify the initial value, multiplier, percent decay rate, and $B(4)$.	**28.** A deposit of $\$2500$ earns 6% annual interest compounded monthly. Write a model and find the value after 3 years.
29. A substance has initial mass 64 grams and half-life 8 hours. Write a model, find the mass after 24 hours, and find when 4 grams remain.	**30.** A population starts at 1500 and doubles every 7 years. Write a model, find the population after 21 years, and find when the population reaches 48000.

Objective: I can solve exponential equations and inequalities using common bases, logarithms, and substitutions.

31. Solve: $2^x = 32$.	**32.** Solve: $3^{x-1} = 27$.
33. Solve: $5^{2x+1} = 125$.	**34.** Solve: $4e^{0.6x} = 20$.
35. Solve: $7(1.2)^x = 35$.	**36.** Solve: $50(0.8)^x = 20$.

Noble Educators | Noble Learners

Name: _____
Date: _____ Class: Math 3 Honors, per: _____

Exponential Functions Worksheet & Review

Objective: I can solve advanced exponential equations, inequalities, and real-world exponential models.

37. Solve: $2^{x+1} = 3^{x-2}$.	**38.** Solve: $e^{2x} - 5e^{x} + 6 = 0$.
39. Solve the inequality: $3 \cdot 2^{x} > 24$.	**40.** Solve the inequality: $6\left(\frac{1}{2}\right)^{x-3} + 2 \leq 5$.
41. A cell culture begins with 500 cells and doubles every 6 hours. Write a model and find the number of cells after 24 hours.	**42.** A medicine dosage is 200 mg and decreases by 15% each hour. Write a model and determine when the amount is below 50 mg.
43. A bank account starts with $\$3000$ and grows continuously at 4.5% per year. Write a model and find the value after 10 years.	**44.** A town grows from 2400 people to 3000 people in 4 years. Write an exponential model $P(t) = ab^{t}$, identify the annual growth rate, and predict the population after 10 years.

Noble Educators | Noble Learners

Name: _____
Date: _____ Class: Math 3 Honors, per: _____

Exponential Functions Worksheet & Review

Objective: I can apply exponential functions to half-life, asymptotic behavior, sequences, comparisons, data modeling, and cumulative feature analysis.

45. Carbon-14 has a half-life of about 5730 years. If a sample begins with 100% of its carbon-14, write a model, find the percent remaining after 5730 years, and find when 12.5% remains.	**46.** A hot drink cools according to $T(t) = 70 + 90e^{-0.12t}$. Find the horizontal asymptote, interpret it, find $T(10)$, and solve for when $T(t) = 100$.
47. The sequence $6, 8.4, 11.76, \ldots$ is exponential. Write an explicit formula, a recursive formula, and find the 5th term.	**48.** Account A is $A(t) = 1000(1.05)^t$. Account B is $B(t) = 1000+70t$. Which account is larger at $t = 10$? At what whole-number year does Account A first exceed Account B?
49. An exponential model $y = ab^x$ passes through $(0, 12)$ and $(3, 96)$. Find a, b, and the model.	**50.** For $F(x) = 2 \cdot 3^{x-1} - 4$, find the domain, range, growth/decay, transformations, horizontal asymptote, intercepts, increasing/decreasing interval, and solve $F(x) = 14$.

Other topics for review:

- Parent functions $y = b^x$ and $y = e^x$, including growth when $b > 1$ and decay when $0 < b < 1$.
- Domain, range, horizontal asymptotes, intercepts, end behavior, and increasing/decreasing intervals.
- Transformations: vertical stretch/compression, reflection, horizontal/vertical shifts.
- Growth factor, decay factor, percent change, compound interest, half-life, and doubling time.
- Exponential equations solved by common bases, logarithms, natural logarithms, and substitution.
- Connections among tables, graphs, equations, sequences, and contextual models.