Exponential, Logistic, and Growth Models

Exponential structure, compound interest, growth and decay, logistic behavior, Newton-style models, and data fitting.

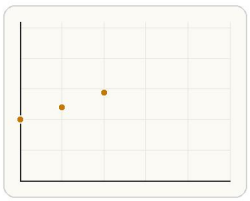
Name _____ Date _____

32 main | 2-up grid | 11 pages | visible side quests

Completion Reward

Shown here as a small pack artifact, not a preview destination.

1. In y = 500(1.2)^x, what does 1.2 represent?



In an exponential model, 1.2 means each step multiplies the quantity by 1.2, which is 20% growth.

A. A 20% growth factor each step
B. A 1.2 unit additive increase
C. The y-intercept
D. The x-intercept

1.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

1.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

1.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

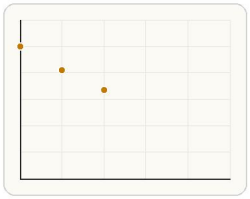
1.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

1.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

2. Which base represents exponential decay?



Exponential decay occurs when each step multiplies by a factor strictly between 0 and 1.

A. 1.18
B. 0.82
C. 2
D. 10

2.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

2.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

2.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

2.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

2.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

3. In y = 75(1.3)^x, what is the initial value?

The coefficient in front is the starting amount before any growth steps happen.

A. 1.3
B. 0
C. 30
D. 75

3.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

3.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

3.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

3.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

3.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

4. What growth factor matches 7% growth per period?

A. 0.93
B. 7
C. 0.07
D. 1.07

4.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

4.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

4.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

4.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

4.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

5. What decay factor matches 15% decay per period?

A. 0.85
B. 1.15
C. 0.15
D. 1.85

5.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

5.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

5.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

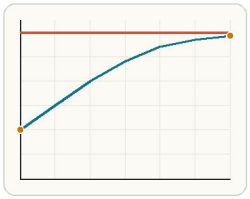
5.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

5.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

6. What makes a logistic model different from pure exponential growth?



Unlike exponential growth, a logistic curve levels off near a limiting value or carrying capacity.

A. It levels off toward a limiting value.
B. It always decreases.
C. It never uses a growth factor.
D. It changes by a fixed additive amount each step.

6.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

6.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

6.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

6.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

6.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

7. Which model shows 5% growth from an initial value of 80?

A. y = 80(1.05)^x
B. y = 80(0.95)^x
C. y = 5(1.8)^x
D. y = 80 + 5x

7.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

7.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

7.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

7.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

7.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

8. Which model shows 30% decay from an initial value of 40?

A. y = 40(0.7)^x
B. y = 40(1.3)^x
C. y = 30(0.4)^x
D. y = 40 - 0.3x

8.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

8.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

8.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

8.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

8.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

9. For y = 200(0.6)^x, what happens as x increases?

A. The outputs approach 0.
B. The outputs approach 200.
C. The outputs become negative.
D. The outputs grow without bound.

9.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

9.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

9.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

9.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

9.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

10. For a logistic model with carrying capacity 500, what happens in the long run?

A. The outputs always stay at 0.
B. The outputs alternate positive and negative.
C. The outputs level off near 500.
D. The outputs must become exactly 1.

10.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

10.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

10.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

10.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

10.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

11. What is the best first step when writing an exponential model from percent growth?

A. Convert the percent to a growth factor.
B. Square the percent.
C. Take a logarithm immediately.
D. Subtract the percent from the initial value.

11.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

11.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

11.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

11.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

11.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

12. A student says 12% growth means add 12 inside the exponent base. What is the mistake?

A. Percent growth changes the multiplicative factor to 1.12, not 12.
B. They should divide by 12 instead.
C. They should always use base 12.
D. Growth should be written linearly, not exponentially.

12.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

12.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

12.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

12.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

12.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

13. Evaluate y = 200(1.5)^x when x = 2. Answer with a number.

13.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

13.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

13.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

13.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

13.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

14. Evaluate y = 80(0.9)^x when x = 3. Answer with a number.

14.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

14.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

14.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

14.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

14.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

15. A population starts at 300 and grows by 10% each year. What is the population after 1 year? Answer with a number.

15.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

15.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

15.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

15.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

15.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

16. A medicine amount starts at 50 mg and decays by 20% per hour. What amount remains after 1 hour? Answer with a number.

16.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

16.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

16.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

16.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

16.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

17. Find A for A = 1000(1.05)^2. Answer with a number.

17.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

17.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

17.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

17.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

17.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

18. **For P(x) = 100 / (1 + 4(0.5)^x), find P(0). Answer with a number.**

18.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

18.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

18.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

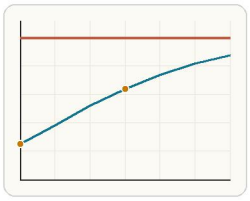
18.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

18.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

19. **For P(x) = 250 / (1 + 3(0.7)^x), what value is the carrying capacity? Answer with a number.**



The curve rises and then levels off near its long-run cap.

19.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

19.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

19.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

19.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

19.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

20. **Evaluate T(t) = 20 + 60(0.8)^t at t = 1. Answer with a number.**

20.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

20.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

20.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

20.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

20.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

21. A value starts at 500 and grows by 8% each period. What is the value after 2 periods? Answer with a number.

21.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

21.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

21.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

21.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

21.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

22. A value starts at 240 and decays by 25% each period. What is the value after 2 periods? Answer with a number.

22.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

22.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

22.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

22.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

22.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

23. Evaluate y = 64(0.5)^3. Answer with a number.

23.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

23.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

23.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

23.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

23.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

24. For y = 900(0.97)^x, what is the initial amount? Answer with a number.

24.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

24.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

24.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

24.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

24.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

25. Use y = 12(1.5)^x to find y when x = 2. Answer with a number.

25.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

25.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

25.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

25.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

25.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

26. For P(x) = 60 / (1 + 2(0.5)^x), find P(1). Answer with a number.

26.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

26.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

26.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

26.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

26.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

27. What percent increase corresponds to factor 1.18? Answer with a number.

27.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

27.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

27.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

27.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

27.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

28. Write an exponential growth model for an initial value of 400 with 6% growth per period. Answer in the form y = ...

28.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

28.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

28.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

28.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

28.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

29. Write an exponential decay model for an initial value of 90 with 12% decay per period. Answer in the form y = ...

29.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

29.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

29.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

29.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

29.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

30. Write a model for $500 invested at 4% annual growth. Answer in the form A = ...

30.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

30.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

30.3. What is 3^4?

A. 12
B. 27
C. 64
D. 81

30.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
C. Subtract 3 each step
D. Add 10 then subtract 10

30.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

31. Write the general logistic form with carrying capacity 120. Answer in the form P = ...

31.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

31.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
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31.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8

32. A table shows values 12, 18, 27, 40.5. Write the exponential model if x starts at 0. Answer in the form y = ...

x	y
0	12
1	18
2	27
3	40.5

A constant multiplicative factor shows up as the same ratio from row to row.

32.1. A quantity grows by 20% each step. What is the growth factor?

A. 0.2
B. 1.2
C. 1.02
D. 20

32.2. A quantity decays by 15% each step. What is the decay factor?

A. 0.15
B. 0.85
C. 1.15
D. 1.85

32.3. What is 3^4?

A. 12
B. 27
C. 64
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32.4. Which pattern is exponential?

A. Add 5 each step
B. Multiply by 2 each step
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32.5. In y = 4(2)^x, what is the initial value?

A. 2
B. 4
C. 6
D. 8