Three Career Offers: Linear vs. Exponential Pay — Teacher Guide

Financial Algebra · Unit 13: Exponential Growth & Decay

2–3 class periods | Pairs or groups of 3 | Skills: Skill 1, Skill 2, Skill 3, Skill 4

Overview

Jordan, a new graduate, has three fictional job offers. One gives a flat raise each year; two give percent raises. Your team will model each salary, find when one passes another, total the pay over different stays, and account for the car Jordan must buy for one of the jobs, which loses value every year.

Skills covered

- Model exponential growth (exponential-skill-01)
- Model depreciation and decay (exponential-skill-02)
- Compare linear and exponential change (exponential-skill-03)
- Find doubling time and half-life (exponential-skill-04)

Required materials

- Student packet
- Spreadsheet or graphing calculator

Suggested pacing

Session	Focus
Day 1	Tasks 1–2
Day 2	Tasks 3–4
Day 3 (optional)	Task 5 and presentations

Implementation guidance

- Totals: the first year is t = 0 (the starting salary).
- Let students build the year-by-year table in a spreadsheet.

Worked calculations

Task 1

1. $A(t) = 42{,}000 + 2{,}400t$; $B(t) = 40{,}000(1.05)^t$; $C(t) = 46{,}000(1.025)^t$.
2. t = 0: A $42,000.00, B $40,000.00, C $46,000.00
3. t = 5: A $54,000.00, B $51,051.26, C $52,044.78
4. t = 10: A $66,000.00, B $65,155.79, C $58,883.89
5. t = 15: A $78,000.00, B $83,157.13, C $66,621.72
6. t = 20: A $90,000.00, B $106,131.91, C $75,376.36

Task 2

1. B first pays more than A at t = 11.

Task 3

1. 5 years: A $234,000.00, B $221,025.25, C $241,791.11
2. 10 years: A $528,000.00, B $503,115.71, C $515,355.56
3. 20 years: A $1,296,000.00, B $1,322,638.17, C $1,175,054.27

Task 4

1. Car after 5 years: $26{,}000(0.85)^5 \approx \$11{,}536.34$; value lost ≈ $14,463.66.

Sample student responses

> "Over 5 years Offer C pays the most ($241,791.11), but the car loses about $14,463.66. Over 20 years Offer B's 5% raises win ($1,322,638.17)."

Common misconceptions

- Comparing only starting salaries.
- Adding 5% of the starting salary every year (linear, not exponential).

Differentiation

Support

- Give a spreadsheet with the year column filled in.

Extend

- Adjust all three for 3% inflation.

Extension opportunities

- Look up typical raises in a career you are interested in.

100-point rubric

Category (points)	Exemplary (100%)	Proficient (~80%)	Developing (~60%)	Beginning (~30%)
Financial understanding (20)	Uses vocabulary precisely and explains every financial concept involved, including assumptions.	Mostly accurate explanations with minor vocabulary gaps.	Partial understanding; some concepts misapplied.	Little evidence of understanding.
Mathematical accuracy (25)	Linear and exponential models, totals and depreciation correct.	1–2 minor errors that do not change conclusions.	Several errors or missing work.	Calculations largely missing or incorrect.
Analysis & comparison (20)	Compares every option on the same basis and tests at least one changed assumption.	Compares options with small gaps.	Comparison superficial or uneven.	Little analysis.
Justification (15)	Recommendation is supported by specific numbers and weighs non-financial factors and risks.	Mostly supported.	Mostly opinion.	No justification.
Communication & presentation (10)	Clear, organized, well-labeled tables, charts, and writing.	Minor clarity issues.	Hard to follow in places.	Disorganized.
Completion (10)	Every checklist item complete.	One item missing.	Two or three items missing.	Most items missing.

Total: 100 points. Alternative recommendations earn full credit when supported by accurate evidence.

Student documents (reference)

Offers (fictional)

Offer	Start	Raise each year
A	$42,000	+$2,400
B	$40,000	+5%
C	$46,000	+2.5% (requires a $26,000 car)