Linear models: equations, inequalities and intersections — Teacher answers

Year 8, lower volume • text pp. 67–74 • textbook lessons 34–37

Use the two prerequisite checks to choose support. Project the worked and guided tasks, then collect the eight paper core questions. Follow-ups and extensions are optional; accept other complete valid methods. This page does not save learners' paper answers.

Ordinary route: prerequisites 4, short inquiry 5, worked/guided 8, independent 15, correction 5, exit 3 minutes. Advanced route: inquiry 18, organise 4, selected practice 13, exit 5 minutes.

Prerequisites: Linear functions, equations, inequalities and simultaneous equations.

Ordinary route: use the first fixed case for the five-minute demonstration. Advanced route: complete the full investigation.

1. 3′ Predict when plans A=2n and B=n+6 cost the same and which is cheaper for small whole-number usage.
2. 8′ Use the existing two-plan tariffs inquiry: fixed fee 6, rate 1, minimum usage 0 and budget 100; or draw both given lines on paper. Record n=4,6,8 and costs (8,10),(12,12),(16,14). The one-line inquiry cannot display both plans simultaneously and its intercept control does not reach 6.
3. 5′ Explain the crossing (6,12), the cost inequality on each side and n as a nonnegative whole number. Connecting lines help comparison; a fractional use is not a valid count.
4. 2′ Individually choose the cheaper plan at n=7, with both calculated costs and units.

Worked example 1

A delivery costs a fixed 6 dollars plus 2 dollars per item. Write C in terms of item count n and find the cost of 5 items.

Reference answer

$C = 2n + 6$, $C(5) = 16$ dollars.

$$C = 2n + 6, \quad C(5) = 16$$

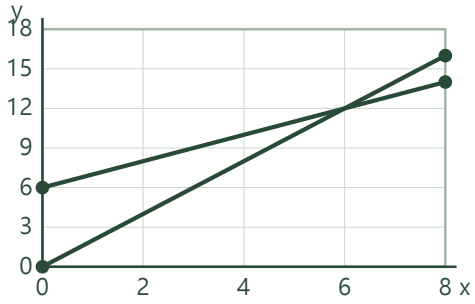
1. The fixed fee is paid once; the item charge is 2n.
2. C(5)=2×5+6=16.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Guided attempt 2

For a nonnegative whole-number count n of uses, plan A costs 2n dollars and plan B costs n+6 dollars. Find the equal-cost point and explain its two coordinates.

1. Equal costs: $2n = \square + 6$.
2. Subtract n: $n = \square$; cost = $2 \times \square = \square$.
3. Intersection (number of uses, cost) = (____, ____).



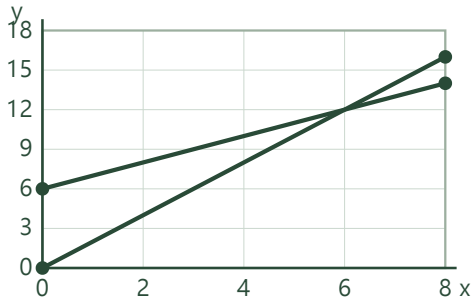
Continuous comparison lines over the displayed window 0–8; actual numbers of uses are nonnegative whole numbers.

Reference answer

$(6, 12)$

1. Equal costs give $2n = n + 6$, so $n = 6$.
2. 6 is a nonnegative whole number, so it is an allowed count. Both plans cost 12 dollars.
3. The crossing means 6 uses and a 12-dollar cost, not 12 uses and 6 dollars.

- Equate the two original cost expressions and verify the common cost.
- Check that the count is a nonnegative whole number and interpret both coordinates with units.



Continuous comparison lines over the displayed window 0–8; actual numbers of uses are nonnegative whole numbers.

Prerequisite 3

Find the x-intercept and explain why y is set to zero.

$$y = 3x - 6$$

Reference answer

$x = 2$

$$x = 2$$

1. Every point on the x-axis has y=0.
2. Solve $3x - 6 = 0$ to obtain $x = 2$.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Prerequisite 4

For the given function, solve $y > 0$. Explain the required part of the graph.

$$y = 2x - 4$$

Reference answer

$x > 2$

$$x > 2$$

1. The zero is $x = 2$.
2. Use the slope sign to select the correct side, and include the zero only for a non-strict inequality.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Independent practice 5

Profit P=3n−12 dollars for a whole-number sales count n≥0. Find all counts with no loss.

$$y = 3x - 12$$

Reference answer

$n \in \{4, 5, 6, \ldots\}$

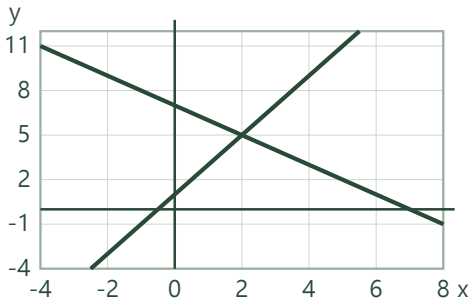
$$n \in \{4, 5, 6, \ldots\}$$

1. The zero is $x = 4$.
2. Use the slope sign to select the correct side, and include the zero only for a non-strict inequality.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Independent practice 6

Find the common point of the two given lines, or explain why there is none or there are infinitely many.



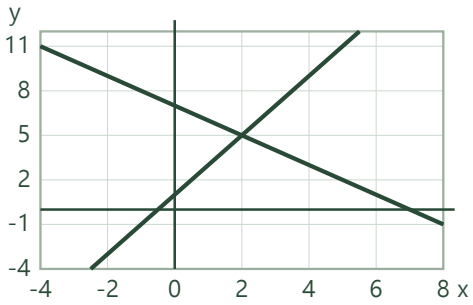
Use the stated conditions and the labelled scales.

Reference answer

$(2, 5)$

1. Equate the two expressions for y.
2. Solve for x, then substitute into both lines to verify y.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.



Use the stated conditions and the labelled scales.

Independent practice 7

Find the x-intercept and explain why y is set to zero.

$$y = -2x + 6$$

Reference answer

$x = 3$

$$x = 3$$

1. Every point on the x-axis has y=0.
2. Solve $-2x + 6 = 0$ to obtain $x = 3$.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Independent practice 8

A tank starts with 5 L and gains 2 L/min for 10 minutes. Write V(t), its stated time domain, and V(10).

Reference answer

$V = 2t + 5, \quad 0 \le t \le 10, \quad V(10) = 25$ L.

$$V = 2t + 5, \quad 0 \le t \le 10, \quad V(10) = 25$$

1. Include the initial 5 L; time is restricted to the stated 10-minute stage.
2. Substitute t=10 to obtain 25 L.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Exit question 9

For the given function, solve $y \geq 0$. Explain the required part of the graph.

$$y = -1x + 4$$

Reference answer

$x \leq 4$

$$x \leq 4$$

1. The zero is $x = 4$.
2. Use the slope sign to select the correct side, and include the zero only for a non-strict inequality.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Exit question 10

Find the x-intercept and explain why y is set to zero.

$$y = 4x - 8$$

Reference answer

$x = 2$

$$x = 2$$

1. Every point on the x-axis has y=0.
2. Solve $4x - 8 = 0$ to obtain $x = 2$.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Further practice 11

For whole-number uses n≥0, plan A costs 2n+5 and B costs 3n. When is A strictly cheaper?

Reference answer

$n \in \{6, 7, 8, \ldots\}$

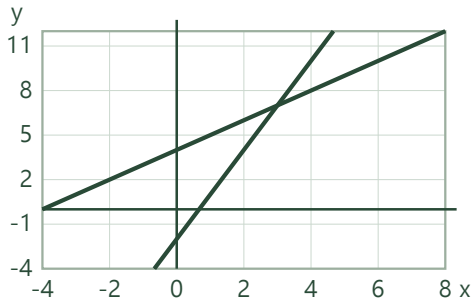
$$n \in \{6, 7, 8, \ldots\}$$

1. A−B=5−n; require 5−n<0.
2. Thus n>5, and the whole-number restriction starts at 6.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Further practice 12

Find the common point of the two given lines, or explain why there is none or there are infinitely many.



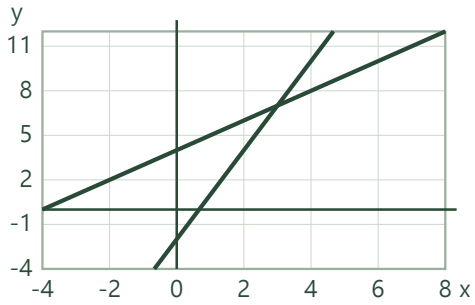
Use the stated conditions and the labelled scales.

Reference answer

$(3, 7)$

1. Equate the two expressions for y.
2. Solve for x, then substitute into both lines to verify y.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.



Use the stated conditions and the labelled scales.

Further practice 13

For the given function, solve $y \leq 0$. Explain the required part of the graph.

$$y = 2x - 6$$

Reference answer

$x \leq 3$

$$x \leq 3$$

1. The zero is $x = 3$.
2. Use the slope sign to select the correct side, and include the zero only for a non-strict inequality.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Further practice 14

For a whole-number input n≥0, y=n−3. Find the smallest input giving y>0.

$$y = 1x - 3$$

Reference answer

4.

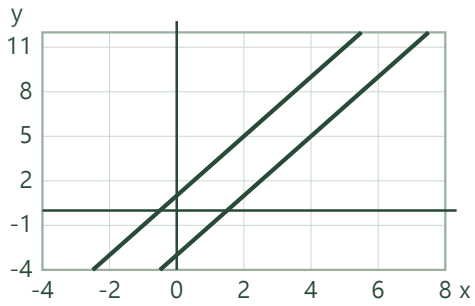
$$n = 4$$

1. The zero is $x = 3$.
2. Use the slope sign to select the correct side, and include the zero only for a non-strict inequality.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.

Extension 15

Find the common point of the two given lines, or explain why there is none or there are infinitely many.



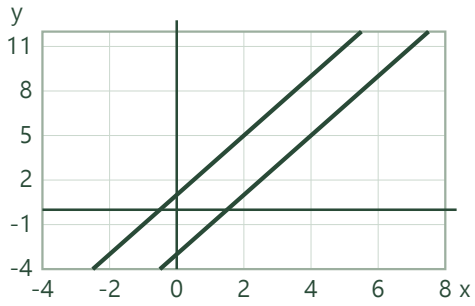
Use the stated conditions and the labelled scales.

Reference answer

No common point: the distinct lines are parallel.

1. Equate the two expressions for y.
2. Compare slopes and intercepts after simplifying.

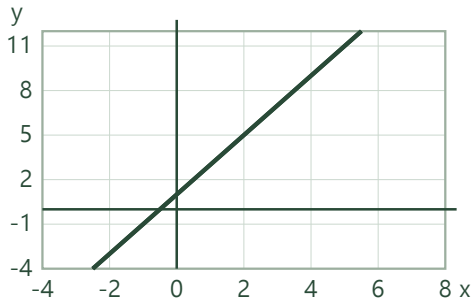
- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.



Use the stated conditions and the labelled scales.

Extension 16

Find the common point of the two given lines, or explain why there is none or there are infinitely many.



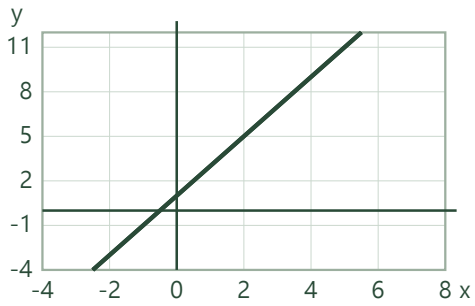
Use the stated conditions and the labelled scales.

Reference answer

Every point on the same line is common.

1. Equate the two expressions for y.
2. Compare slopes and intercepts after simplifying.

- Use the stated conditions and justify the relation before calculating.
- Give an exact answer where possible, with units and any domain restrictions.



Use the stated conditions and the labelled scales.