# Linear models and inequalities applications test

16 questions | 47 marks | 60 minutes

Build, solve and evaluate models for prices, counts, budgets and capacity.

Equivalent correct methods earn the corresponding marks.

**1.** A room hire costs 18 dollars plus 6 dollars per hour. The final charge is 54 dollars. Find the number of hours. [2 marks]

$18 + 6h = 54$, so $h = 6$.

**Answer:** 6 hours.

**2.** A number is tripled and reduced by 4. The result is 17. Find the number. [2 marks]

$3x - 4 = 17$, so $x = 7$.

**Answer:** 7.

**3.** A delivery company charges 12 dollars plus 3 dollars per kilometre. Another charges 20 dollars plus 2 dollars per kilometre. Find the distance at which their prices match. [3 marks]

$12 + 3d = 20 + 2d$ gives $d = 8$.

**Answer:** 8 km; both prices are 36 dollars.

**4.** At a market, 2 apples and 3 pears cost 13 dollars, while 1 apple and 1 pear cost 5 dollars. Find the prices. [3 marks]

From $a + p = 5$, double and subtract from $2a + 3p = 13$ to get $p = 3$.

**Answer:** Apple: 2 dollars; pear: 3 dollars.

**5.** A school sells 30 tickets at either 8 dollars or 5 dollars. The total is 192 dollars. Find how many of each price were sold. [3 marks]

$a + b = 30$, $8a + 5b = 192$; $3a = 42$.

**Answer:** 14 tickets at 8 dollars and 16 tickets at 5 dollars.

**6.** Two parking models are $C = 3h + 4$ and $C = 3h + 7$. Explain whether they have a break-even duration. [2 marks]

Equal hourly rates give parallel distinct cost lines.

**Answer:** No; the second always costs 3 dollars more.

**7.** A teacher models a score using $S = 2p + 6$ and also $2S = 4p + 12$. Do these equations determine one value of $p$? Explain. [3 marks]

The second is twice the first; it supplies no new information.

**Answer:** No. They are equivalent, so every allowed value of $p$ satisfies both when $S = 2p + 6$.

**8.** A club has 90 dollars and spends 15 dollars on equipment. Each entry costs 6 dollars. Find the maximum whole number of entries it can buy. [3 marks]

$15 + 6n \le 90$ gives $n \le 12.5$; counts are whole numbers.

**Answer:** 12 entries.

**9.** A refrigerated box must stay below 5 degrees Celsius. Its temperature is modelled by $T = 17 - 2t$, where $t$ is in minutes. Solve the condition on $t$. [3 marks]

$17 - 2t < 5$ gives $-2t < -12$ and hence $t > 6$.

**Answer:** $t > 6$ minutes.

**10.** A bus has 40 seats. Let $a$ and $c$ count adults and children. Write a capacity inequality and state the variable domains. [2 marks]

Each passenger uses one seat.

**Answer:** $a + c \le 40$, with $a, c$ nonnegative integers.

**11.** A stall can spend at most 60 dollars on notebooks costing 4 dollars and pens costing 2 dollars. Let $n, p$ be their counts. Write the budget constraint and test buying 10 notebooks and 12 pens. [3 marks]

Its cost is $40 + 24 = 64$ dollars.

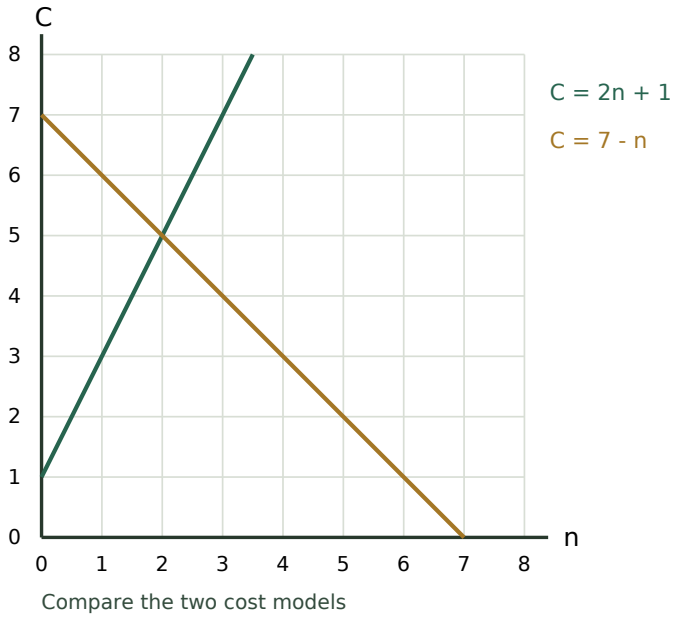
**Answer:** $4n + 2p \le 60$; the proposed purchase is not feasible.

**12.** A business must make at least 5 products. Product A takes 2 hours and B takes 3 hours; at most 18 hours are available. Write the inequalities. [3 marks]

Use the product total and labour limit separately.

**Answer:** $a + b \ge 5$, $2a + 3b \le 18$, with nonnegative integer counts.

**13.** The graph shows two cost models, $C = 2n + 1$ and $C = 7 - n$, for the limited input range shown. Use the graph and algebra to find their equal value. [3 marks]




Compare the two cost models

$2n + 1 = 7 - n$ gives $3n = 6$.

**Answer:** $n = 2$, $C = 5$.

**14.** A word problem produces a solution of -3 adult tickets and 15 child tickets. Explain what this tells you and one thing to check before accepting the model. [3 marks]

Counts of sold tickets cannot be negative.

**Answer:** The solution is not physically valid. Check the stated totals, prices and how the equations were formed.

**15.** A plan must satisfy $x + y \geq 8$ and $3x + 2y \leq 20$, with nonnegative whole-number counts. Test plans $(4, 4)$ and $(5, 3)$. [4 marks]

Both produce 8 items.

Their resource uses are 20 and 21 respectively.

**Answer:** $(4, 4)$ is feasible; $(5, 3)$ is not.

**16.** A council hires 12 vehicles, each a 4-seat car or a 7-seat van. [5 marks]

**(a)** There are exactly 66 seats. Find the number of each vehicle. [3 marks]

$c + v = 12$, $4c + 7v = 66$.

Substituting $c = 12 - v$ gives $3v = 18$, hence $v = 6, c = 6$.

**Answer:** 6 cars and 6 vans.

**(b)** Could there instead be exactly 67 seats using 12 vehicles of these types? Explain. [2 marks]

The equations would give $3v = 19$, which is not a whole-number van count.

**Answer:** No.