# 5.12 Solving Simultaneous Equations Graphically: 1-hour Pack

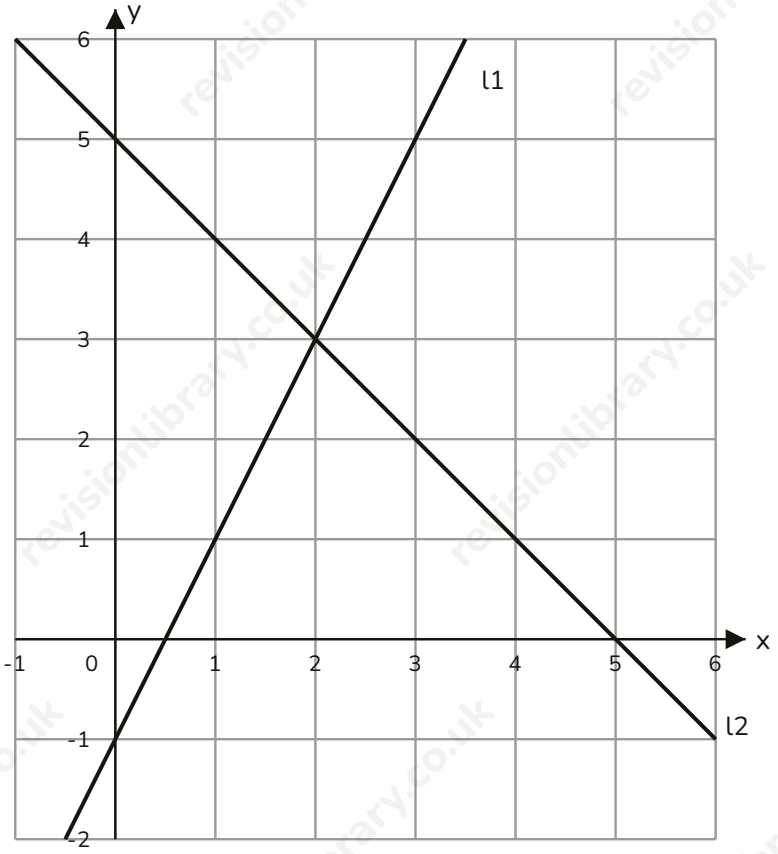
Total Marks

EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** The diagram shows two straight lines, l1 and l2, drawn on the same grid. l1 has equation y = 2x - 1 and l2 has equation y = -x + 5.




**(a)** Write down the coordinates of the point where l1 and l2 intersect. **(1)**

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**(b)** Hence write down the solution to the simultaneous equations $y = 2x - 1$ and $y = -x + 5$. **(2)**

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**(Total for Question 1 is 3 marks)**

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**2** The graphs of two straight lines intersect at the point (-3, 4). Which of the following is the solution to the pair of simultaneous equations represented by the lines?

- ☐ A) $x = 4, y = -3$
- ☐ B) $x = -3, y = 4$
- ☐ C) $x = 3, y = -4$
- ☐ D) $x = -4, y = -3$

**(Total for Question 2 is 1 mark)**

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**3** On a grid, draw the graphs of $y = 2x - 4$ and $y = 4x - 10$ for values of x from -5 to 7. Use your graphs to solve the simultaneous equations. (State the values of x and y where the lines cross.)

**(Total for Question 3 is 3 marks)**

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**4** The lines $y = 2x$ and $y = 2x + 4$ are drawn on the same grid. Explain what the graph shows about the solutions of the simultaneous equations.

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**(Total for Question 4 is 2 marks)**


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**5** Two taxi firms charge as follows. Firm A: a fixed charge of £3 plus £4 per mile. Firm B: a fixed charge of £6 plus £3 per mile. Draw a graph of the cost against the number of miles for each firm on the same axes, and use it to find the number of miles for which the two firms charge the same, and what that charge is.

**(Total for Question 5 is 3 marks)**

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**6** Complete the table of values for $y = 3x - 2$, for $x = -3, 0, 1, 5$. Give the four y values in order.

**(Total for Question 6 is 2 marks)**

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**7** Show that the point (2, 3) is the solution to the simultaneous equations $y = x + 1$ and $y = -2x + 7$.

**(Total for Question 7 is 2 marks)**

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**8** Two straight lines have equations $y = 2x + 3$ and $y = 2x - 1$.

**(a)** Without drawing the graphs, state whether the two lines are parallel. Give a reason for your answer. **(2)**

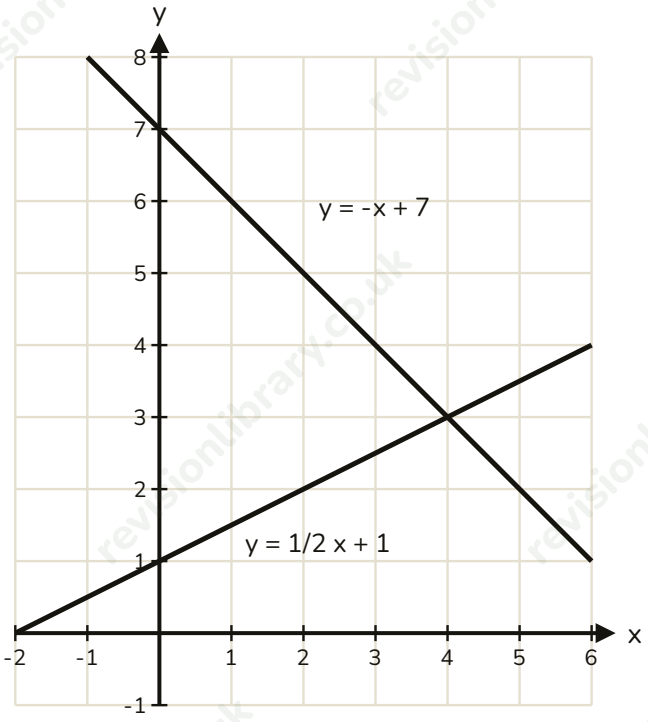
**(b)** Hence explain what this tells you about the solution to the simultaneous equations $y = 2x + 3$ and $y = 2x - 1$. **(1)**

**(Total for Question 8 is 3 marks)**


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**9** The graphs of $y = 1/2\ x + 1$ and $y = -x + 7$ are drawn on the grid.

Write down the solution of the simultaneous equations $y = 1/2\ x + 1$ and $y = -x + 7$.




**(Total for Question 9 is 2 marks)**

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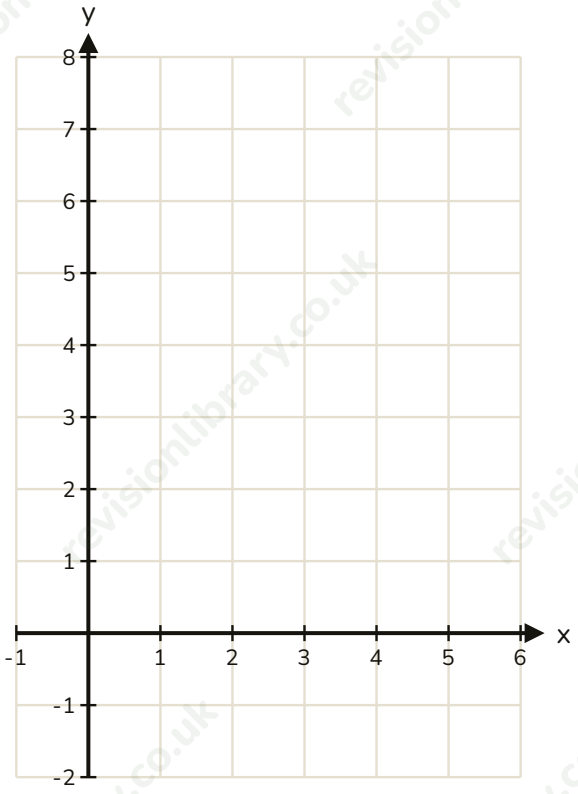
**10** Which pair of simultaneous equations below has no solution, because the two lines are parallel?

- ☐ A) $y = 2x + 5$ and $y = 5x + 2$
- ☐ B) $3x + y = 8$ and $y = 3x - 8$
- ☐ C) $2y = 4x + 6$ and $y = 2x - 1$
- ☐ D) $y = x + 4$ and $2x - y = 4$

**(Total for Question 10 is 1 mark)**


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**11** Solve the simultaneous equations $x + y = 7$ and $y = 2x - 2$ by drawing suitable straight-line graphs.




**(a)** Rearrange $x + y = 7$ to make y the subject. **(1)**

**(b)** By drawing suitable graphs on the grid, solve the simultaneous equations $x + y = 7$ and $y = 2x - 2$. **(4)**

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**(Total for Question 11 is 5 marks)**


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**12** A line with equation $y = 0.5x + 1$ and a parabola with equation $y = x^2 - 2x + 2$ are drawn on the same axes. Work out the x-coordinates of their points of intersection.

**(Total for Question 12 is 3 marks)**

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**13** Sketch on the same axes the graphs of $y = -x + 6$ and $y = x^2 - 4x + 3$ and use your sketch to estimate the x-coordinates of their intersections. Give your answers to 1 decimal place.

**(Total for Question 13 is 3 marks)**

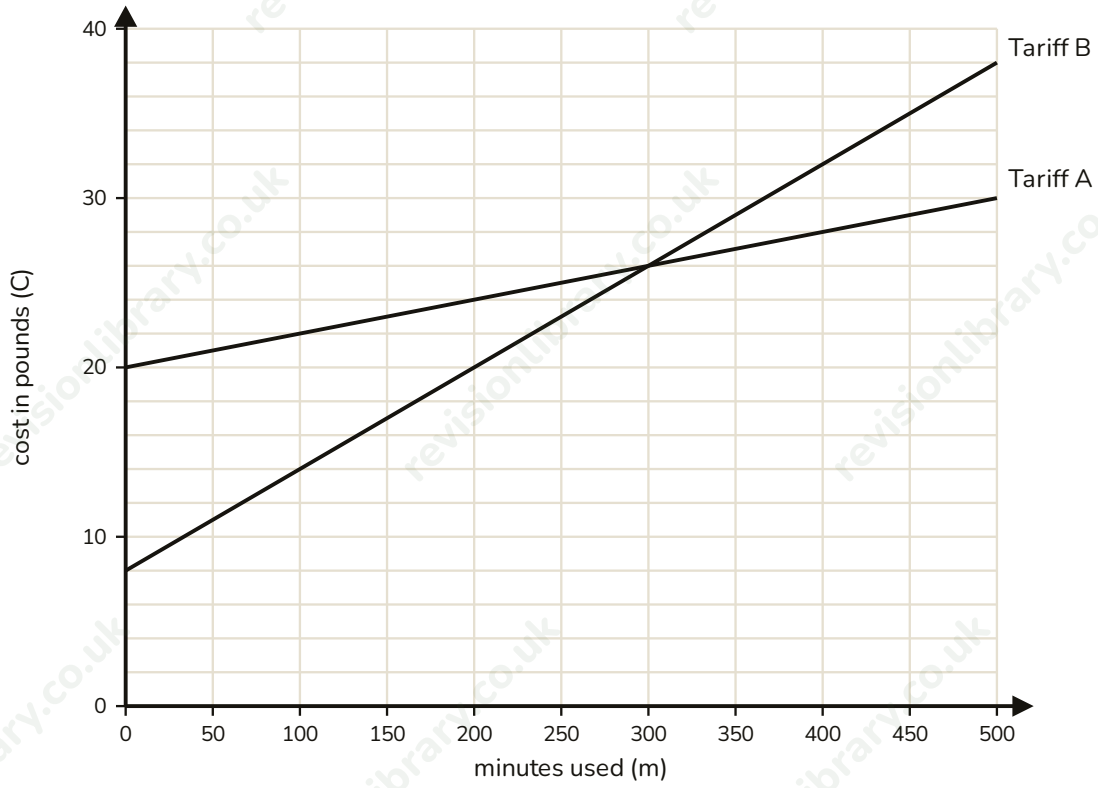

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**14** Priya is comparing two mobile phone tariffs.

Tariff A: monthly cost C (pounds) = 20 + 0.02m, where m is the number of minutes used.

Tariff B: monthly cost C (pounds) = 8 + 0.06m.

The graphs of Tariff A and Tariff B are shown on the grid for $0 \leq m \leq 500$.




**(a)** Use the graph to write down the number of minutes for which the two tariffs cost the same amount. **(1)**

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**(b)** A customer uses 150 minutes in a month. State which tariff is cheaper, and by how much. **(3)**

**(c)** Bilal uses more than 400 minutes a month. Which tariff should he choose? Give a reason using the graph. **(2)**

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**(Total for Question 14 is 6 marks)**


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**15** Two straight lines are drawn on the same grid and cross at a single point. Explain why the point of intersection gives the solution to the pair of simultaneous equations.

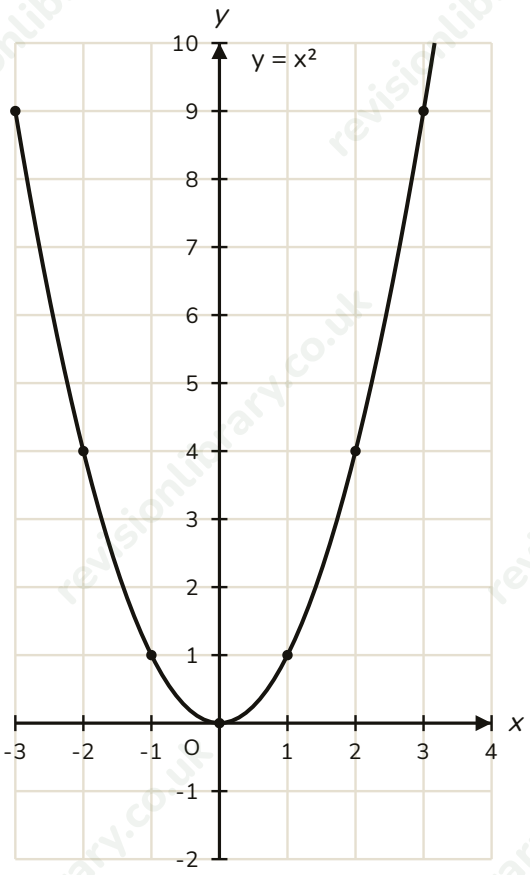
**(Total for Question 15 is 2 marks)**

**16** Without drawing any graphs, show that the simultaneous equations $y = 4x - 3$ and $8x - 2y = 7$ do not have a solution.

**(Total for Question 16 is 3 marks)**


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**17** The curve $y = x^2$ is drawn on the grid.




**(a)** On the same grid, draw the graph of $y = x + 2$. **(2)**

**(b)** Hence write down the two pairs of values (x, y) that solve the simultaneous equations $y = x^2$ and $y = x + 2$. **(2)**

**(Total for Question 17 is 4 marks)**


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# Mark scheme · 5.12 Solving Simultaneous Equations Graphically: 1-hour Pack

## Question 1

(a) (2, 3) **B1**

**(a) Answer: (2, 3)**

(b) x = 2 (ft from (a)) **B1**

(b) y = 3 (ft from (a)) **B1**

**(b) Answer: x = 2, y = 3**

## Question 2

B **B1**

**Answer: B) x = -3, y = 4**

## Question 3

plots at least two correct points or a table for one line **M1**

both lines drawn correctly **M1**

x = 3, y = 2 cao **A1**

**Answer: x = 3, y = 2**

## Question 4

lines have the same gradient **B1**

lines never meet so there is no solution **B1**

**Answer: No solution because the lines are parallel**

## Question 5

line for Firm A drawn or equation C = 4x + 3 **M1**

line for Firm B drawn or equation C = 3x + 6 **M1**

3 miles, £15 cao **A1**

**Answer: 3 miles, £15**

## Question 6

substitutes at least two x values correctly **M1**

-11, -2, 1, 13 cao **A1**

**Answer: -11, -2, 1, 13**

## Question 7

substitutes x = 2 into both equations **M1**

shows y = 3 from both equations, cso, so (2,3) satisfies both equations **A1**

**Answer: y = 2 + 1 = 3 and y = -2(2) + 7 = 3, both give y = 3, so (2,3) satisfies both equations**

## Question 8

(a) yes, the lines are parallel **B1**

(a) reason: both lines have the same gradient (coefficient of x = 2) **B1**

**(a) Answer: Yes, the lines are parallel because they both have gradient 2**

(b) the equations have no solution because parallel lines with different y-intercepts never meet **B1**

**(b) Answer: There is no solution, since the lines never intersect**

## Question 9

x = 4 **B1**

y = 3 (oe as a coordinate pair) **B1**

**Answer: x = 4, y = 3**

## Question 10

C **B1**

**Answer: C) 2y = 4x + 6 and y = 2x - 1**

## Question 11

(a) y = 7 - x (oe) **B1**

**(a) Answer: y = 7 - x**

(b) at least 3 correct points for y = 7 - x, e.g. (0,7), (3,4), (6,1), ft from (a) **M1**

(b) at least 3 correct points for y = 2x - 2, e.g. (0,-2), (2,2), (4,6) **M1**

(b) both correct straight lines drawn **A1**

(b) states solution x = 3, y = 4 (ft from their graphs, intersection identified) **B1**

**(b) Answer: x = 3, y = 4**

## Question 12

equate $x^2 - 2x + 2 = 0.5x + 1$ to form quadratic $x^2 - 2.5x + 1 = 0$ **M1**

use quadratic formula or complete the square to find x **M1**

$x = (2.5 \pm \sqrt{2.25})/2 = (2.5 \pm 1.5)/2$ so x = 2 or x = 0.5 cao **A1**

**Answer:x = 2 and x = 0.5**

**(Points of intersection at x = 2 and x = 1/2)**

## Question 13

sketch showing both graphs with at least one intersection roughly located and correct axes scale **M1**

identify two intersection x-values from sketch within reasonable accuracy **M1**

answers x approx -0.8 and x approx 3.8 to 1 dp (or equivalent to 1 dp) cao **A1**

**Answer: x = -0.8 and x = 3.8 (to 1 decimal place)**

## Question 14

(a) 300 minutes (awrt 300, accept range 290 to 310) **B1**

**(a) Answer: 300 minutes**

(b) substitutes m = 150 into both C = 20 + 0.02m and C = 8 + 0.06m **M1**

(b) Tariff A = £23, Tariff B = £17 **A1**

(b) Tariff B is cheaper by £6 **A1**

**(b) Answer: Tariff B is cheaper, by £6**

(c) Tariff A **B1**

(c) reason: for m > 300, the graph of Tariff A lies below the graph of Tariff B, so Tariff A costs less **B1**

**(c) Answer: Tariff A, because for minutes above 300 its line is below Tariff B's line**


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## Question 15

| | |
|---|---|
| the point of intersection is the only point that lies on both lines | **B1** |
| its coordinates satisfy both equations at the same time, so they give the solution to the pair of simultaneous equations | **B1** |

**Answer: The intersection point is the only point common to both lines, so its (x,y) coordinates are the solution that satisfies both equations simultaneously**

## Question 16

| | |
|---|---|
| rearranges 8x - 2y = 7 to y = 4x - 3.5 (oe, e.g. y = 4x - 7/2) | **M1** |
| compares gradients and states both lines have gradient 4 | **A1** |
| concludes the lines are parallel (different y-intercepts, -3 and -3.5) so the simultaneous equations have no solution | **A1** |

**Answer: No solution - the two lines are parallel (both gradient 4, different y-intercepts)**

## Question 17

| | |
|---|---|
| (a) at least 2 correct points, e.g. (0,2), (2,4) | **M1** |
| (a) correct straight line drawn | **A1** |

**(a) Answer: Straight line through (0,2) and (2,4)**

| | |
|---|---|
| (b) x = -1, y = 1 | **B1** |
| (b) x = 2, y = 4 | **B1** |

**(b) Answer: (-1, 1) and (2, 4)**


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