KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 11

2025 **Level 2 Further Mathematics** 2026

Unit 26 Tasks

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Contents

1 Advanced Straight Line Graphs

Fluency Practice

① Work out the equations of the lines **(i) – (v)** in this diagram.

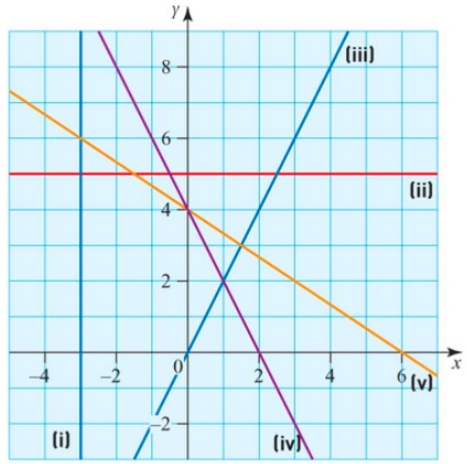


Figure 3.21

② Work out the equations of the lines **(i) – (v)** in this diagram.

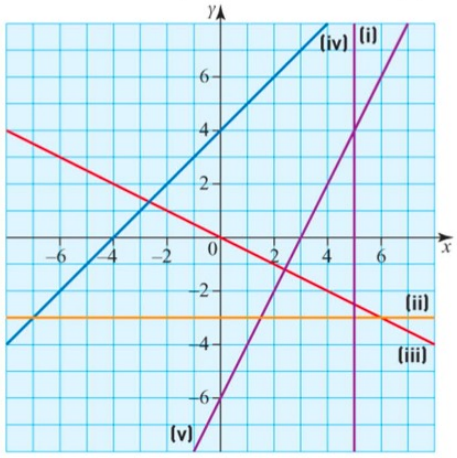


Figure 3.22

③ Work out the equations of these lines.

(i) Gradient 3 and passing through (2, −1)

(ii) Gradient 2 and passing through (0, 0)

(iii) Gradient 3 and passing through (2, −7)

(iv) Gradient 4 and passing through (4, 0)

④ Work out the equations of these lines.

(i) Gradient $\frac{1}{3}$ and passing through (3, 1)

(ii) Gradient $\frac{2}{5}$ and passing through $(-4, -10)$

(iii) Gradient $-\frac{3}{2}$ and passing through $(1, -2)$

(iv) Gradient $-\frac{1}{2}$ and passing through $(0, 6)$

⑤ Work out the equation of the line AB in each of these cases.

(i) A(2, 0) B(3, 1)

(ii) A(3, −1) B(0, 4)

(iii) A(2, −3) B(3, −2)

⑥ Work out the equation of the line AB in each of these cases.

(i) A(−1, 3) B(4, 0)

(ii) A(3, −5) B(10, −6)

(iii) A(−1, −2) B(−4, −8)

⑦ A taxi journey costs £2 plus 80 pence per mile. Use £C to represent the total cost of the journey and m miles to represent the total distance travelled.

(i) Write down an equation giving C in terms of m.

(ii) How much would a journey of 4 miles cost?

(iii) How far could I travel if I only had £10?

⑧ A junior school is ordering exercise books for their students and is working on the assumption that most students will only use 8 books during the year, but they want to order an additional 100. Let N represent the number of books to be ordered and let s be the number of students enrolled for the year.

(i) Write down an equation giving N in terms of s.

(ii) The exercise books cost £1.50 each. If there are 240 students that year, what would be the total cost of the books?

(iii) The school budget for exercise books is only £3000. How could the order be amended?

Fluency Practice

① By calculating the gradients of the following pairs of lines, state whether they are parallel, perpendicular or neither.

(i) $x = 2$
$y = -2$

(ii) $y = 2x$
$y = -2x$

(iii) $x + 2y = 1$
$2x - y = 1$

(iv) $y = x - 3$
$x - y + 4 = 0$

(v) $y = 3 - 4x$
$y = 4 - 3x$

(vi) $x + y = 5$
$x - y = 5$

(vii) $x - 2y = 3$
$y = \frac{1}{2}x - 1$

(viii) $x + 3y - 4 = 0$
$y = 3x + 4$

(ix) $2y = x$
$2x + y = 4$

(x) $2x + 3y - 4 = 0$
$2x + 3y - 6 = 0$

(xi) $x + 3y = 1$
$y + 3x = 1$

(xii) $2x = 5y$
$5x + 2y = 0$

② Work out the equations of these lines.

(i) Parallel to $y = 3x$ and passing through $(3, -1)$.

(ii) Parallel to $y = 2x + 3$ and passing through $(0, 7)$.

(iii) Parallel to $y = 3x - 4$ and passing through $(3, -7)$.

(iv) Parallel to $4x - y + 2 = 0$ and passing through $(5, 0)$.

(v) Parallel to $3x + 2y - 1 = 0$ and passing through $(3, -2)$.

(vi) Parallel to $2x + 4y - 5 = 0$ and passing through $(0, 5)$.

③ Work out the equations of these lines.

(i) Perpendicular to $y = 2x$ and passing through $(0, 0)$.

(ii) Perpendicular to $y = 3x - 1$ and passing through $(0, 4)$.

(iii) Perpendicular to $y + x = 2$ and passing through $(3, -1)$.

(iv) Perpendicular to $2x - y + 4 = 0$ and passing through $(1, -1)$.

(v) Perpendicular to $3x + 2y + 4 = 0$ and passing through $(3, 0)$.

(vi) Perpendicular to $2x + y - 1 = 0$ and passing through $(4, 1)$.

④ Points P and Q have coordinates P$(3, -1)$ and Q$(5, 7)$.

(i) Work out the gradient of PQ.

(ii) Work out the coordinates of the midpoint of PQ.

(iii) The perpendicular bisector of a line PQ is the line which is perpendicular to PQ and passes through its midpoint. Work out the equation of the perpendicular bisector of PQ.

⑤ A triangle has vertices P$(2, 5)$, Q$(-2, -2)$ and R$(6, 0)$.

(i) Sketch the triangle.

(ii) Work out the coordinates of L, M and N, which are the midpoints of PQ, QR and RP respectively.

(iii) Work out the equations of the lines LR, MP and NQ (these are the medians of the triangle).

(iv) Show that the point $(2, 1)$ lies on all three of these lines. (This shows that the medians of a triangle are concurrent.)

⑥ The straight line with equation $2x + 3y - 12 = 0$ cuts the x-axis at A and the y-axis at B.

(i) Sketch the line.

(ii) Work out the coordinates of A and B.

(iii) Work out the area of triangle OAB where O is the origin.

(iv) Work out the equation of the line which passes through O and is perpendicular to AB.

(v) Work out the length of AB and, using the result in (iii), calculate the shortest distance from O to AB.

⑦ A quadrilateral has vertices at the points A$(-7, 0)$, B$(2, 3)$, C$(5, 0)$ and D$(-1, -6)$.

(i) Sketch the quadrilateral.

(ii) Work out the gradient of each side.

(iii) Work out the equation of each side.

(iv) Work out the length of each side.

(v) Work out the area of the quadrilateral.

⑧ £10 000 is invested and simple interest of 2% per annum is received on this investment. (Simple interest is when the interest received each year is calculated on the initial investment in the account only.)

(i) Calculate the interest received after each of the first three years.

(ii) Sketch the graph of interest against time and write down its equation.

(iii) Use the equation to work out how long it would take for the investment to reach £11 000

⑨ A spring has an unstretched length (often called the natural length) of 20 cm. When it is hung with a load of 50 g attached, its stretched length is 25 cm.

Assuming that the extension of the spring is proportional to the load at all times

(i) calculate the load corresponding to an extension of 12.5 cm

(ii) calculate the extension corresponding to a load of 75 g

(iii) calculate the extension corresponding to a load of 800 g and comment on your answer.

2 Three Linear Simultaneous Equations

Solve the simultaneous equations:

$$x + y + z = 6$$
$$2x + 3y - z = 4$$
$$x + 5y + 2z = 13$$

Solve the simultaneous equations:

$$x + y + 2z = 12$$
$$5x - 2y + z = 22$$
$$x - y + z = 9$$

Solve the simultaneous equations:

$$x + y + z = 0$$
$$-2x + y + 2z = 7$$
$$4x - y - z = -5$$

1 banana, 1 apple and 1 orange costs 90p. 2 bananas, 3 apples and 1 orange costs £1.90. 4 bananas, 1 apple and 3 oranges costs £2.50. Work out the cost of each piece of fruit.

Explain why it is not possible to solve these three simultaneous equations.

$$x + y + z = 6$$
$$2x + 2y + 2z = 12$$
$$x + 3y - z = 10$$

Fluency Practice

three variables
find out the value of each letter

(1)

$$a + b = 12$$
$$b + c = 10$$
$$a + c = 16$$

(2)

$$d + 2e = 16$$
$$e + 2f = 16$$
$$f + 2d = 13$$

(3)

$$2g + 3h + j = 10$$
$$g + 2h + 3j = 13$$
$$3g + h + 2j = 13$$

(4)

$$2k + 3m + 4p = 38$$
$$4k + 2m + 3p = 32$$
$$3k + 4m + 2p = 38$$

Now solve the following simultaneous equations in three unknowns.

1.

$$\begin{aligned} x + y + z &= 1 \\ 2x + 3y + z &= 6 \\ x - y + 2z &= -5 \end{aligned}$$

2.

$$\begin{aligned} x + y + z &= 1 \\ x - y + 2z &= 2 \\ 2x + 3y + 3z &= 3 \end{aligned}$$

3.

$$\begin{aligned} 2a + b + 3c &= -7 \\ a - b + 2c &= -4 \\ 3a + 2b - c &= 11 \end{aligned}$$

4.

$$\begin{aligned} 2x + 3y - z &= 2 \\ 4x - y + 2z &= 5 \\ 2x + y - 3z &= -4 \end{aligned}$$

5.

$$\begin{aligned} x - y + z &= 1 \\ 2x + 2y + 3z &= 1 \\ x - y - 4z &= 2 \end{aligned}$$

6.

$$\begin{aligned} a + 2b + c &= 3 \\ 2a + b + c &= 1 \\ a - b + 2c &= 0 \end{aligned}$$

7.

$$\begin{aligned} p + q + r &= -1 \\ 2p + q + 2r &= -1 \\ p + 3q &= 1 \end{aligned}$$

Fluency Practice

8.

$$\begin{aligned} x + y - z &= 1 \\ x - 2y + 3z &= 0 \\ x - y + 2z &= -1 \end{aligned}$$

9.

$$\begin{aligned} 4x - 5y + 2z &= -2 \\ 5x + 7y + 3z &= 3 \\ 2x + 3y + z &= 1 \end{aligned}$$

Fluency Practice

① (i) Solve, by eliminating z:
$$2x + 3y + z = 12$$
$$3x + 2y + z = 13$$
$$4x - 5y + z = 8$$

(ii) Solve, by eliminating y:
$$3x + y - 2z = 4$$
$$5x - y + 3z = 22$$
$$2x + y + 4z = 13$$

(iii) Solve, by eliminating x:
$$2x - 3y + 4z = -7$$
$$2x + 2y - 3z = 19$$
$$2x - 5y + 2z = -3$$

② (i) Solve $x + 2y + 3z = 13$
$$2x + 3y - z = -7$$
$$3x - y + 2z = 18$$

(ii) Solve $2x - y + 2z = 16$
$$3x + 2y - z = 5$$
$$x + 4y - 3z = -13$$

(iii) Solve $4x + 2y - z = 29$
$$-x + 3y + 2z = -16$$
$$2x + y - 3z = 22$$

(iv) Solve $5x + 3y + 2z = 8$
$$7x - 4y + 4z = 20$$
$$3x + 2y - 2z = 3$$

③ (i) Solve $2a - 5b + 2c = -36$, $3a + 4b - 3c = 10$ and $4a - 3b + 4c = -44$

(ii) Solve $3p + 5q - 2r = 13$, $4p - 2q + 5r = -25$ and $-2p + 3q - 7r = 25$

(iii) Solve $2\alpha + 3\beta + 2\gamma = 1$, $4\alpha - 2\beta - 5\gamma = 15$ and $-5\alpha + 4\beta + \gamma = -42$

④ (i) Solve $x + 3y = 2z - 23$, $2y = 3x - 4z + 2$ and $5z - 2x = 3y + 37$

(ii) Solve $2x = y + z + 13$, $5y - x = 2z - 16$ and $3z + 2y = 11 - x$.

(iii) Solve $y + 5 = 3x$, $2x - z = 7$ and $4y = 3z + 13$

PS ⑤ $x = 3$, $y = 5$, $z = 1$ is the solution to the simultaneous equations
$$ax + by + cz = 28$$
$$az - cy = 2bx + 10$$
$$bz = ax + 3cy + 26$$
Work out the values of a, b and c.

PS ⑥ 7, 9, 13 are the first three terms of a sequence with nth term $= an^2 + bn + c$.

(i) By substituting $n = 1, 2$ and 3 set up three simultaneous equations in a, b and c.

(ii) Solve your simultaneous equations and hence write down an expression for the nth term.

PS ⑦ 9, 16 and 42 are the 2nd, 3rd and 5th terms of a quadratic sequence.
Work out the nth term of the sequence.

PS ⑧ If (x, y, z) are the general coordinates of a point in a 3-dimensional coordinate system, then each of the equations
$$5x - 2y + z = 3$$
$$z = x + y$$
$$2x + 6y = 5z$$
represents a plane. Solve the equations and hence write down the coordinates of the point at which the three planes meet.

Students of Level 2 Further Mathematics will not need to have any understanding of plane geometry. This question is for interest only.

Purposeful Practice

1 Solve the following simultaneous equations:

a

$$a + b + c = 4$$
$$a + 3b - 2c = -23$$
$$a + b + 3c = 14$$

?

b

$$3x + y + z = 18$$
$$x + 3y + z = 18$$
$$2x - 2y - z = -2$$

?

c

$$a + b + 2c = 0$$
$$2a + 2b + 3c = 2$$
$$a - b + c = -2$$

?

d

$$x + y + 3z = -4$$
$$2x + 3y - 3z = 22$$
$$x + y + 2z = -1$$

?

e

$$x - 3y - 3z = -20$$
$$x + 2y + z = 17$$
$$x - 3y - 2z = -17$$

?

f

$$2a + 3b + 3c = 18$$
$$3a - b + 3c = 12$$
$$a + 2b - c = 13$$

?

2 *[CCEA AS June 2019 P1 Pure Q1a]*
Solve the simultaneous equations

$$x + 2y + 3z = 9$$
$$2x - y + 4z = 17$$
$$3x + y - z = 2$$

?

3 Nathan, Basma and Lauren are all buying snacks for a party.
Nathan buys 2 milkshakes, 3 cupcakes, and 5 bags of sweets for £21.
Basma buys 3 milkshakes, 6 cupcakes and 15 bags of sweets for £51.
Lauren buys 5 milkshakes, 4 cupcakes and 10 bags of sweets for £37.
How much does each item cost?

?

4 *[SMC 2012 Q7]*

Given that $x + y + z = 1$, $x + y - z = 2$ and $x - y - z = 3$, what is the value of xyz?

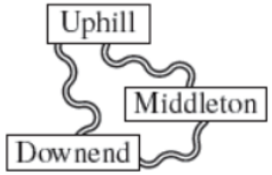
?

[Grey Kangaroo 2021 Q15]

Three villages are connected by paths as shown.

From Downend to Uphill, the detour via Middleton is 1 km longer than the direct path. From Downend to Middleton, the detour via Uphill is 5 km longer than the direct path. From Uphill to Middleton, the detour via Downend is 7 km longer than the direct path.

What is the length of the shortest of the three direct paths between the villages?



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