## Finding unknown coefficients

A line or a linear function will be in the form

$f(x) = ax + b$, where $a$ and $b \in \mathbb{Z}$

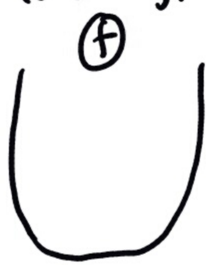
$y = \underline{2}x + 3$ ← y intercept

slope

A parabola - quadratic

$f(x) = ax^2 + bx + c$, where $a, b$ and $c \in \mathbb{Z}$

Two types of quadratic




$ax^2 + bx + c$
where $a > 0$


$-ax^2 + bx + c$
where $a < 0$

Eg 1) Find the value of $a$, if $\underbrace{f(\overset{y}{x})}_{} = ax - 6$ and $f(\overset{x}{2}) = -\overset{y}{2}$

$$a(\overset{x}{2}) - 6 = -\overset{y}{2}$$

$$2a - 6 = -2$$

$$\begin{array}{l|l|l} +6 & 2a = +4 & +6 \\ \div 2 & a = 2 & \div 2 \end{array}$$

Eg2) $g(\overset{y}{x}) = 3x + k$, If $g(\overset{x}{4}) = \overset{y}{10}$ Find the value of k.

$3(\overset{x}{4}) + k = \overset{y}{10}$

$12 + k = 10$

$-12 \quad k = -2 \quad -12$

Eg3) $\overset{y}{f(x)} = ax^2 + 3$ is a function, If $(\overset{x}{-1}, \overset{y}{-1})$ is a couple of this function, find the value of a.

$a(\overset{x}{-1})^2 + 3 = \overset{y}{-1}$

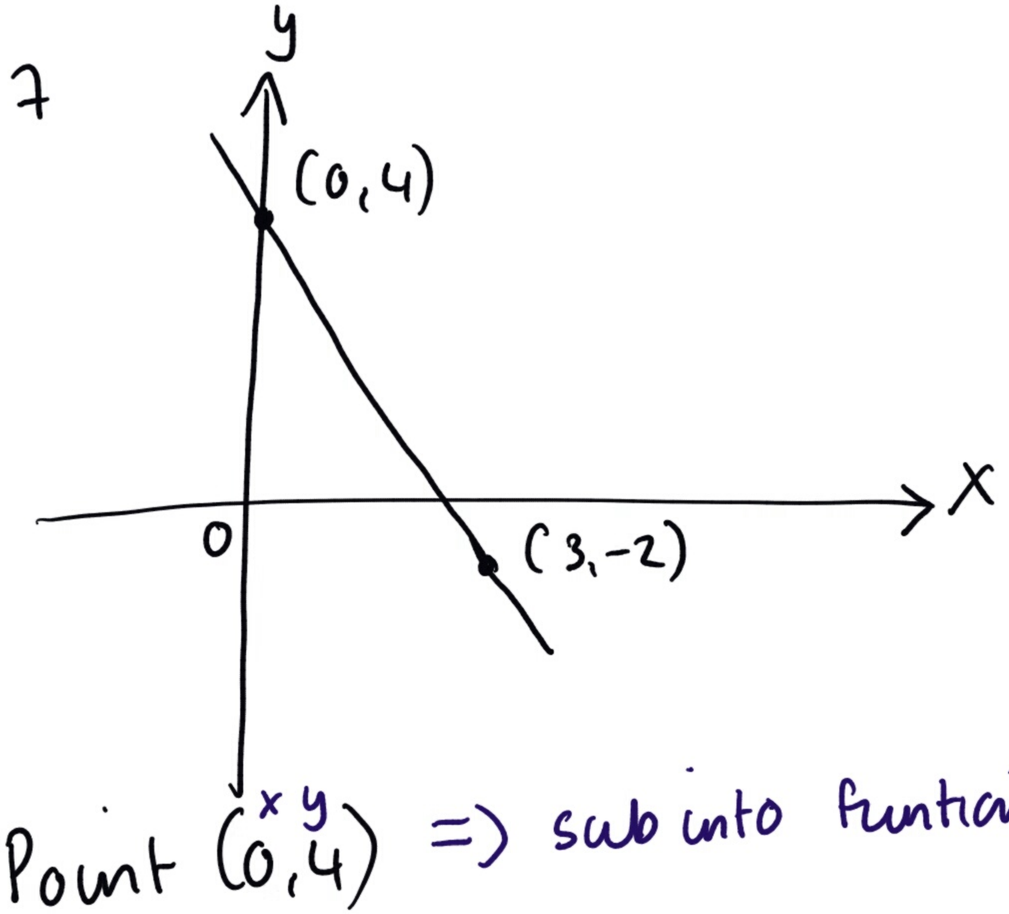
$a + 3 = -1$

$-3 \quad a = -4 \quad -3$

Pg 464

Q2, 4.

Q7




The linear function is given in the form

$f(x) = ax + b$ $\quad f(x) = -2x + 4$

find a and b.

Point $(0,4)$ $\overset{x\ y}{}$ => sub into function $\quad 4 = a(0) + b$ $\quad \overset{y \quad x}{}$

$4 = b$

Point $(3,-2)$ $\overset{x\ y}{}$ => sub into function $\quad -2 = a(3) + 4$ $\quad \overset{y \quad b}{}$

$b = 4$

$-2 = 3a + 4$

$-4 \div 3 \mid -6 = 3a \mid -4 \div 3$

$-2 = a$

Pg 465 Q9

$g(x) = ax^2 + bx + 1$ - Quadratic

If $g(1) = 0$ and $g(2) = 3$.

Find a and b.

① Make an equation

$g(\overset{x}{1}) = \overset{y}{0}$ => sub into function

$a(1)^2 + b(1) + 1 = 0$

$x \quad x \quad y$

$a + b + 1 = 0$

$-1 \mid ① \; a + b = -1 \mid -1$

$a \quad b$

$g(x) = 2x^2 - 3x + 1$

Simultaneous Equations

① $-a + b = +1$ $(-1)$

② $2a + b = 1$

$a = 2$

$(2) + b = -1$

$b = -3$

② Make another equation

$g(\overset{x}{2}) = \overset{y}{3}$ => sub into functions

$a(2)^2 + b(2) + 1 = 3$

$4a + 2b + 1 = 3$

$-1 \mid 4a + 2b = 2 \mid -1$

$2$

② $2a + b = 1$

HW pg 465 Q 10 + 11

Q10 $f(x) = ax^2 + bx + 1$

If $f(1) = 0$ and $f(-1) = 0$

$0 = a(1)^2 + b(1) + 1$

$0 = a + b + 1$

$-1 \mid -1 = a + b \mid -1$

$0 = a(-1)^2 + b(-1) + 1$

$0 = a - b + 1$

$-1 \mid -1 = a - b \mid -1$

$a - b = -1$

$a + b = -1$

$2a = -2$

$a = -1$

$a - b = -1$, where $a = -1$

$(-1) - b = -1$

$+1 \mid -b = 0 \mid +1$

HW
pg 465
Q12

(11) $f(x) = x^2 + px + q$

$f(3) = 4$ (x, y)

$4 = (3)^2 + p(3) + q$

$4 = 9 + 3p + q$

$-9 \mid -5 = 3p + q \mid -9$

$f(-1) = 4$ (x, y)

$4 = (-1)^2 + p(-1) + q$

$4 = 1 - p + q$

$-1 \mid 3 = -p + q \mid -1$

$3p + q = -5$

$-p + q = 3 \quad (-1)$

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$3p + q = -5$

$+p - q = -3$

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$4p = -8$

$p = -2$

$-p + q = 3$

$-(-2) + q = 3$

$+2 + q = 3$

$-2 \mid q = 1 \mid -2$

$f(x) = x^2 - 2x + 1$

$x^2 - 2x + 1 = 0$

$(x - 1)(x - 1) = 0$ $-1x$ $-1x$ $= -2x$

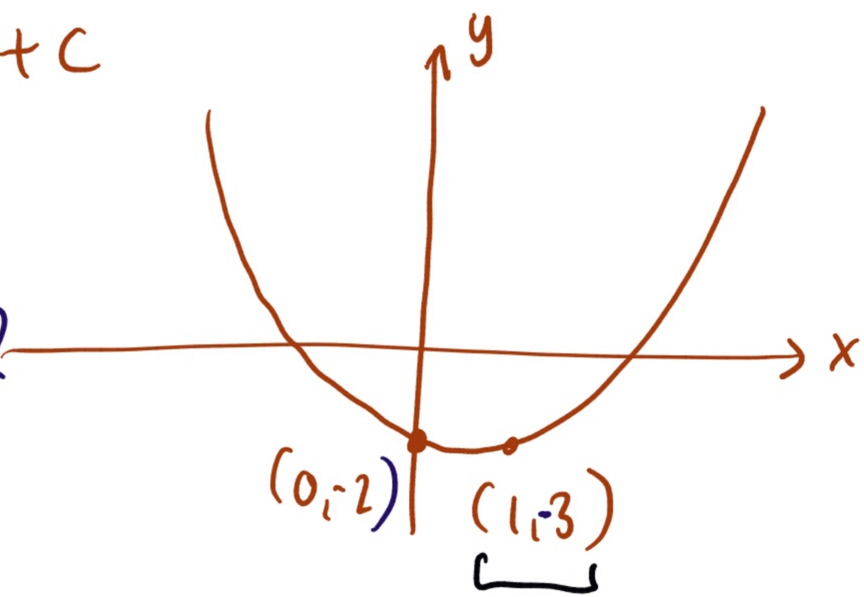
$x = 1$

$+1 \mid x - 1 = 0 \mid +1$

(12) pg 465 $\underbrace{f(x)}_{y} = x^2 + bx + c$

$(\overset{x}{0}, \overset{y}{-2}) \Rightarrow (\overset{x}{0})^2 + b(\overset{x}{0}) + c = \overset{y}{-2}$

$0 + 0b + c = -2$




$(\overset{x}{1}, \overset{y}{-3}) \Rightarrow (1)^2 + b(1) + \overset{c}{(-2)} = -3$

$1 + b - 2 = -3$

$b - 1 = -3$

$+1 \quad\quad b = -2 \quad\quad +1$

$f(x) = x^2 - \overset{b}{2}x - \overset{c}{2}$

Pg 465
Q13

Q13 Pg 465

$f(x) = x^2 + 1$ Quadratic

$g(x) = ax + b$ Line

$f(0) = g(0)$

$x^2 + 1 = ax + b$

$(0)^2 + 1 = a(0) + b$

$1 = b$

$g(\overset{x}{2}) = \overset{y}{15}$ , $b = 1$

$ax + b$

$a(\overset{x}{2}) + (\overset{b}{1}) = \overset{y}{15}$

$2a + 1 = 15$

$-1 \quad 2a = 14 \quad -1$

$\div 2 \quad a = 7 \quad \div 2$

$g(x) = \overset{a}{7}x + \overset{b}{1}$

Q14) $f(x) = x^2 + bx + c$

① $(\overset{x}{-3}, \overset{y}{0})$

$f(-3) = (\overset{x}{-3})^2 + b(\overset{x}{-3}) + c = \overset{y}{0}$

$9 - 3b + c = 0$

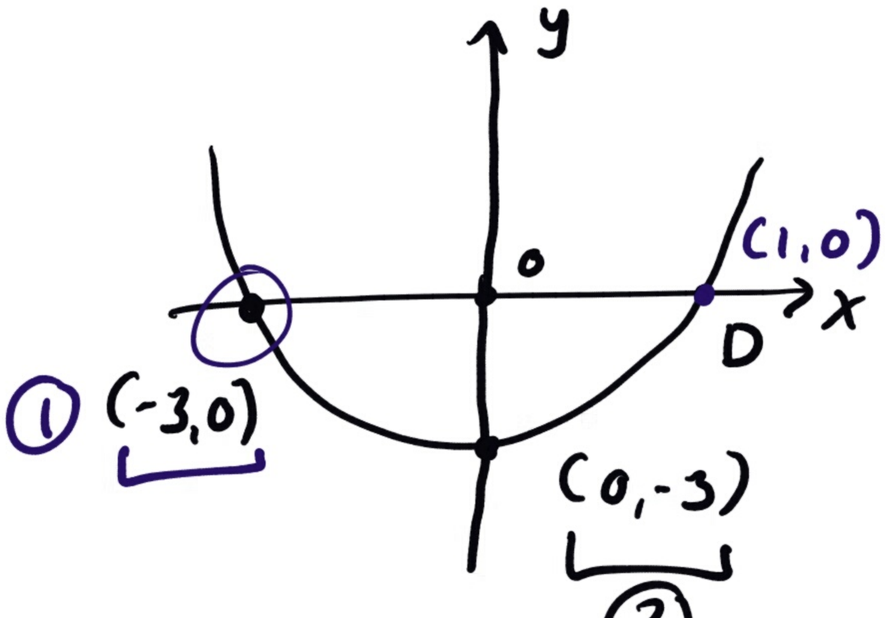
$-9 \quad | \quad -3b + c = -9 \quad | -9$

② $(\overset{x}{0}, \overset{y}{-3})$

$f(0) = (\overset{x}{0})^2 + b(0) + c = \overset{y}{-3}$

$c = -3$

Sub in for c




$-3b + (-3) = -9$

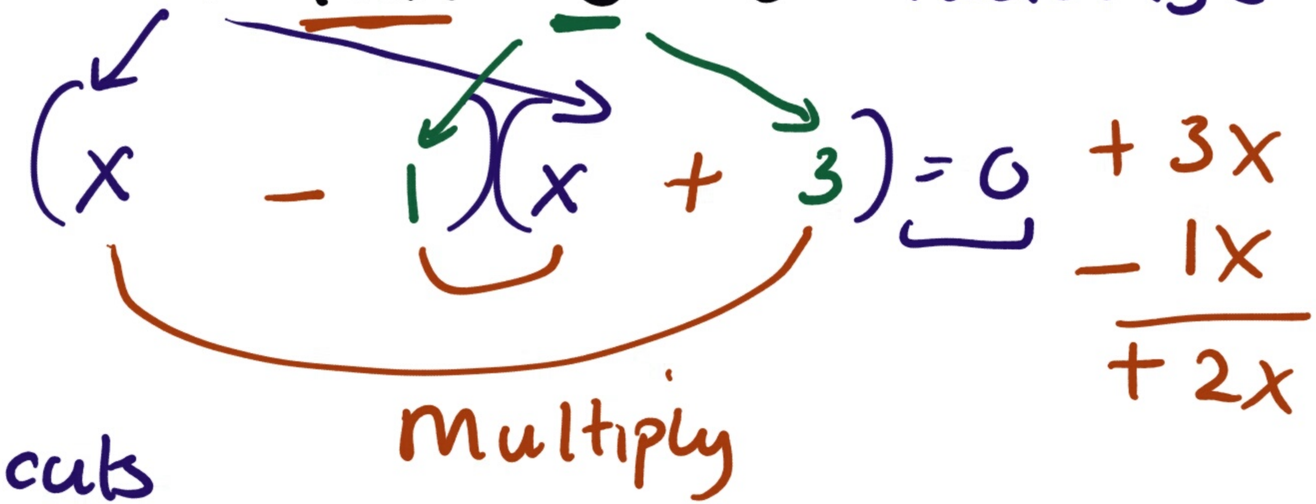
$-3b - 3 = -9$

$+3 \quad | \quad -3b = -6 \quad | +3$

$\div -3 \quad | \quad b = 2 \quad | \div 3$

$b = 2$ , $c = -3$ $\quad f(x) = x^2 + \overset{b}{2}x - \overset{c}{3} = 0$ factorise

factors $(x - 1)(x + 3) = 0$




Find the roots where the quadratic cuts the x axis.

y solve for x

$x - 1 = 0$ $\quad$ $x + 3 = 0$

$+1$ | $x = 1$ | $+1$ $-3$ | $x = -3$ | $-3$

D $(1, 0)$ $\quad$ $(-3, 0)$

15)

$f(x) = x^2 + kx + p$

① $(\overset{x}{4}, \overset{y}{0}) = (\overset{x}{4})^2 + k(\overset{x}{4}) + p = \overset{y}{0}$

$16 + 4k + p = 0$

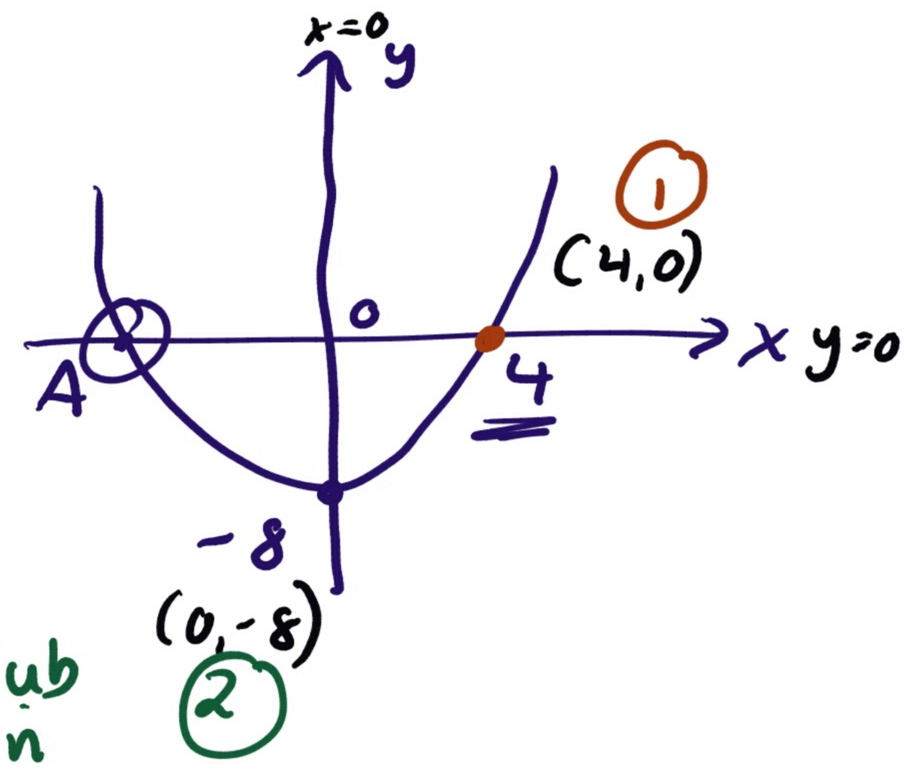
$-16 \mid \quad 4k + p = -16 \quad \mid -16$

② $(\overset{x}{0}, \overset{y}{-8}) = f(\overset{x}{0}) = \overset{y}{-8}$

$(0)^2 + k(0) + p = -8$

$p = -8$

Sub in $p = -8$




$4k + (\overset{p}{-8}) = -16$

$+8 \mid \quad 4k = -8 \quad \mid +8$

$\div 4 \mid \quad k = -2 \quad \mid \div 4$

$f(x) = x^2 - 2x - 8 = 0$

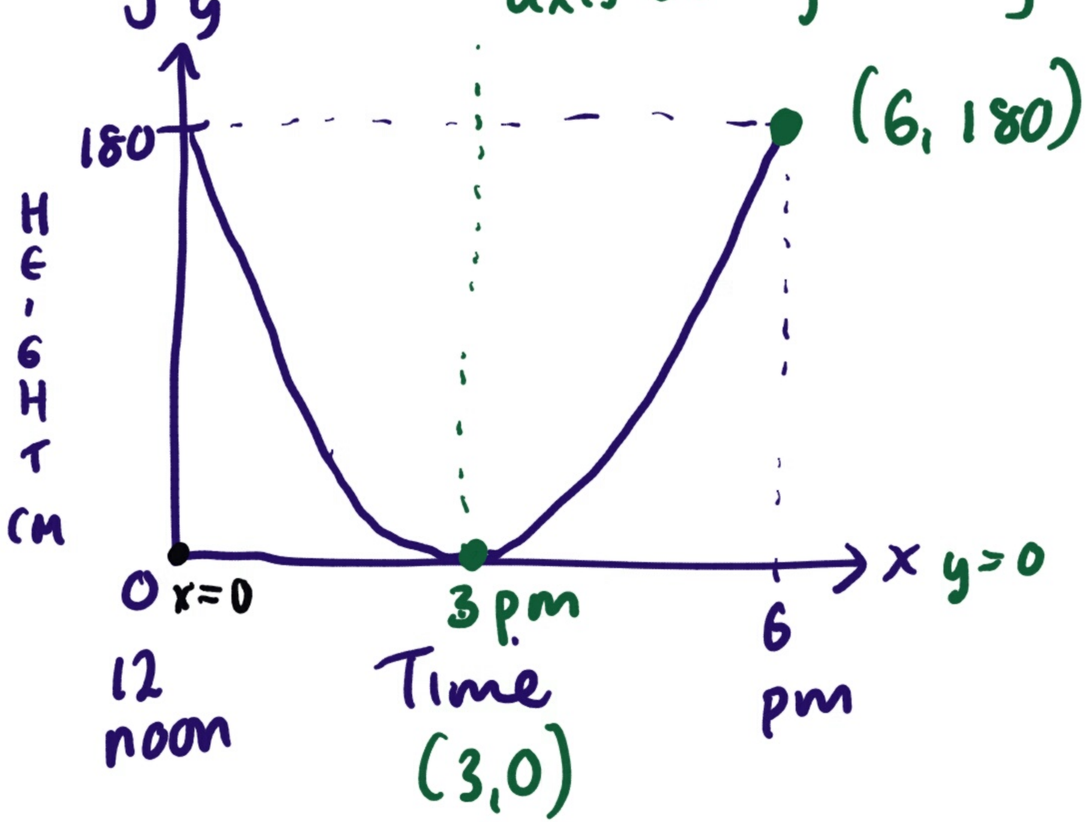
$(x - 4)(x + 2)$ $\quad +2x \quad -4x \quad -2x$

$x - 4 = 0$ $\qquad x + 2 = 0$

$x = 4$ $\qquad x = -2$

* $(4,0)$ $\qquad (-2,0)$ A

Pg 39 w/s




$g(x) = ax^2 + bx + c$ . $a, b, c \in \mathbb{Z}$

on a quadratic c is the y intercept

on y axis $x = 0$

$g(0) = a(0)^2 + b(0) + c = 180$

$g(0) = c = 180$ $(0, 180)$

| | x | y |
|---|---|---|
| Point 1 | 0 | 180 |
| Point 2 | 3 | 0 |
| Point 3 | 6 | 180 |

} use to find a and b

$\overset{x}{3}\ \overset{y}{0}$

$C = 180$

$g(x) = ax^2 + bx + c$

$\underbrace{0}_{g(x)} = a(3)^2 + b(3) + 180$

$0 = 9a + 3b + 180$

$-180 \mid -180 = 9a + 3b \mid -180$

$\overset{x}{6}\ \overset{y}{180}$

$C = 180$

$\overset{y}{180} = a(6)^2 + b(6) + 180$

$180 = 36a + 6b + 180$

$-180 \mid 0 = 36a + 6b \mid -180$

① $9a + 3b = -180$ $(-2)$

② $36a + 6b = 0$

$-18a - 6b = +360$

$36a + 6b = 0$

$18a = 360$

$a = 20$

$36(20) + 6b = 0$

$720 + 6b = 0$

$-720 \mid 6b = -720 \mid -720$

$\div 6 \qquad b = -120 \qquad \div 6$

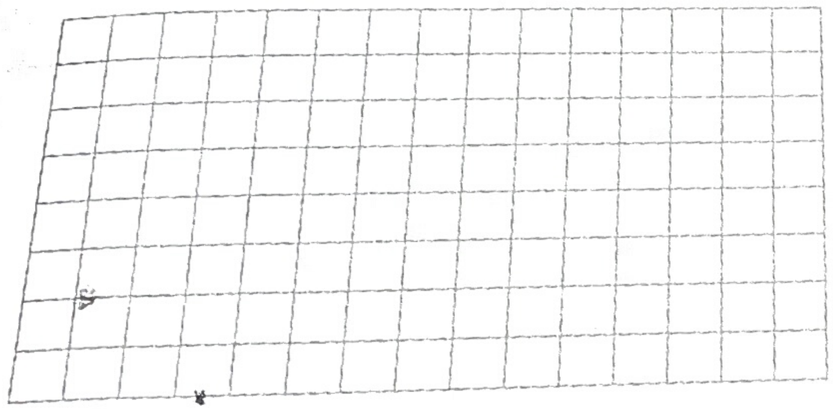
**Question 5** (25 marks)

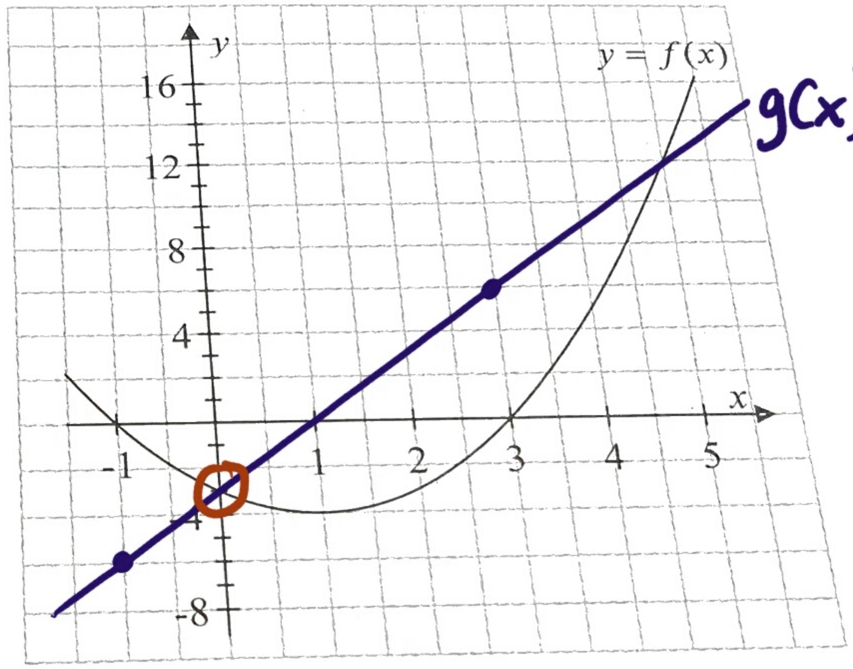
The diagram shows the graph of a function $f$.

**(a)** The graph of another function $g$ is a straight line.

$g(-1) = -6$ and $g(3) = 6$.

Draw the graph of $g$ on the diagram.






Use the graphs to find the two values of $x$ for which $g(x) = f(x)$.

cut each other

(0, -3) (5, 12)

$g(x) = \underline{ax + b}$

$f(x) = x^2 + px + q$ $\quad x^2 - \overset{p}{4}x + \overset{q}{3}$

$f(x)$ = cut x axis $-1$ and $3$

$(\overset{x}{-1}, \overset{y}{0}) = f(-1) = (-1)^2 + p(-1) + q = 0$

$1 - p + q = 0$

$-1 \mid p + q = -1 \mid -1$

$(\overset{x}{3}, \overset{y}{0}) = f(3) = (3)^2 + p(3) + q = 0$

$9 + 3p + q = 0$

$-9 \mid 3p + q = -9 \mid -9$

$p + q = -1 \quad (-1)$

$3p + q = -9$

$-p - q = +1$

$3p + q = -9$

$2p = -8$

$\div 2 \mid p = -4 \mid \div 2$

$(-4) + q = -1$

$-4 + q = -1$

$+4 \mid q = 3 \mid +4$

$$g(x) = \frac{ax + b}{}$$

$x \qquad y$

$g(-1) = -6$

$a(-1) + b = -6$

$-a + b = -6$

$x \qquad y$

$g(3) = 6$

$a(3) + b = 6$

$3a + b = 6$

$-a + b = -6 \quad (-1)$

$3a + b = 6$

$+a - b = +6$

$3a + b = 6$

$4a = 12$

$a = 3$

$-(3) + b = -6$

$-3 + b = -6$

$+3 \mid b = -3 \mid +3$

$g(x) = 3x - 3$

$g(x) = f(x)$

$3x - 3 = x^2 - 4x + 3$

$-3x \quad -3$

$x^2 - 7x + 6 = 0$

$x^2 - 7x + 6 = 0$

$(x - 6)(x - 1) = 0$

$x - 6 = 0$

$x = 6$

$x - 1 = 0$

$x = 1$

$-1x$

$-6x$

$-7x$

c) $g(x) = x^2 - 2x$

$h(x) = g(x) + 2$

$g(x) = x^2 - 2x + 2$

| x | f(x) y |
|---|---|
| -3 | 17 |
| -2 | 10 |
| -1 | 5 |
| 0 | 2 |
| 1 | 1 |
| 2 | 2 |
| 3 | 5 |
| 4 | 10 |

x axis domain - inputs

$-3 \leq x \leq 6$

$\{-3, -2, -1, 0, 1, 2, 3, 4, 5, 6\}$

$k(x) = g(x+2)$

$(x+2)^2 - 2(x+2)$

$x(x+2) + 2(x+2) - 2x - 4$

$x^2 + 2x + \cancel{2x} + \cancel{4} - \cancel{2x} - \cancel{4}$

$= x^2 + 2x$

| x | y f(x) |
|---|---|
| -3 | 3 |
| -2 | 0 |
| -1 | -1 |
| 0 | 0 |
| 1 | 3 |
| 2 | 8 |
| 3 | 15 |
| 4 | 24. |