1 The functions f and g are defined by

$$f : x \to 3x + 4, \qquad x \in \mathbb{R}$$

$$g : x \to \frac{2}{x+3}, \qquad x \in \mathbb{R},\ x \neq 3$$

(a) Evaluate fg(1) **(2)**

(b) Solve the equation $gf(x) = 6$ **(4)**

a/ $g(1) = \frac{2}{1+3} = \frac{1}{2}$

$f\left(\frac{1}{2}\right) = 3\left(\frac{1}{2}\right) + 4$

$= \frac{11}{2}$

b/ $gf(x) = \frac{2}{3x+4+3}$

$= \frac{2}{3x+7}$

$\frac{2}{3x+7} = 6$

$2 = 6(3x + 7)$

$2 = 18x + 42$

$-40 = 18x$

$x = -\frac{20}{9}$

2 The function f is defined by

$$f(x) = x^2 + 2x + 1, \quad x \in \mathbb{R}, \quad x \geq -1$$

(a) State the range of f **(1)**

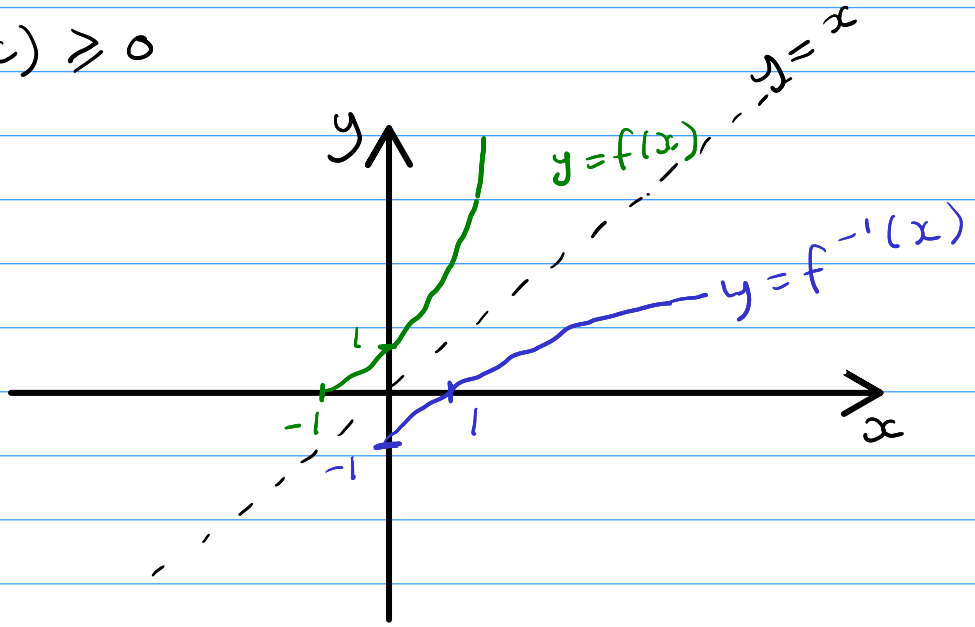
(b) Sketch the graphs of $f(x)$ and $f^{-1}(x)$ on the same diagram **(3)**

(c) Find an expression for $f^{-1}(x)$ and state its domain **(4)**

a/ $f(x) = (x+1)^2$

$f(x) \geq 0$

b/



c/ $y = x^2 + 2x + 1$

$y = (x+1)^2$

$x = (y+1)^2$

$\sqrt{x} = y + 1$

$\sqrt{x} - 1 = y$

$f^{-1}(x) = \sqrt{x} - 1 \qquad x \geq 0$

3 The function f is defined by

$$f(x) = 2 + \ln(2x - 1), \quad x \in \mathbb{R}, \quad x > 0.5$$

(a) Find the exact value of ff(1) **(2)**

(b) Find an expression for $f^{-1}(x)$ **(3)**

a/ $f(1) = 2 + \ln(1)$

$= 2$

$f(2) = 2 + \ln 3$

b/ $y = 2 + \ln(2x - 1)$

$x = 2 + \ln(2y - 1)$

$x - 2 = \ln(2y - 1)$

$e^{x-2} = 2y - 1$

$e^{x-2} + 1 = 2y$

$$y = \frac{e^{x-2} + 1}{2}$$

$$f^{-1}(x) = \frac{e^{x-2} + 1}{2}$$

4 The functions f and g are defined by

$$f : x \to e^x, \qquad x \in \mathbb{R}$$

$$g : x \to 2x + \ln x, \qquad x \in \mathbb{R},\ x > 0$$

(a) Write down the range of f **(1)**

(b) Find an expression for the composite function gf **(2)**

(c) Write down the range of gf **(1)**

a/ $f(x) > 0$

b/ $2e^x + \ln e^x$

$2e^x + x$

c/ $gf(x) \in \mathbb{R}$

5 The function f is defined by

$$f(x) = \frac{1}{x+2}, \qquad x \in \mathbb{R},\ x \neq -2$$

(a) Write down the range of $f(x)$ **(2)**

(b) Find an expression for $f^{-1}(x)$ and state its domain **(3)**

$$g(x) = x^2 - 5, \qquad x \in \mathbb{R}$$

(c) Solve $fg(x) = \frac{1}{2}$ **(3)**

a/ $f(x) \in \mathbb{R}, \quad f(x) \neq 0$

b/ $y = \frac{1}{x+2}$

$x = \frac{1}{y+2}$

$y + 2 = \frac{1}{x}$

$y = \frac{1}{x} - 2$

$f^{-1}(x) = \frac{1}{x} - 2 \quad x \in \mathbb{R}, x \neq 0$

$$fg(x) = \frac{1}{x^2 - 5 + 2}$$

$$= \frac{1}{x^2 - 3}$$

$$\frac{1}{x^2 - 3} = \frac{1}{2}$$

$$x^2 - 3 = 2$$

$$x^2 = 5$$

$$x = \pm\sqrt{5}$$

6 The function f is defined by

$$f(x) = x^2 + 4x + 1, \quad x \in \mathbb{R}$$

(a) Find the range of f(x) **(3)**

(b) Explain why the function f(x) does not have an inverse **(1)**

a/ $(x + 2)^2 - 4 + 1$

$(x + 2)^2 - 3$ Min point $(-2, -3)$

$f(x) \geq -3$

b/ It is a many to one function. (many to one functions do not have an inverse)

7 (a) Sketch the graph with equation

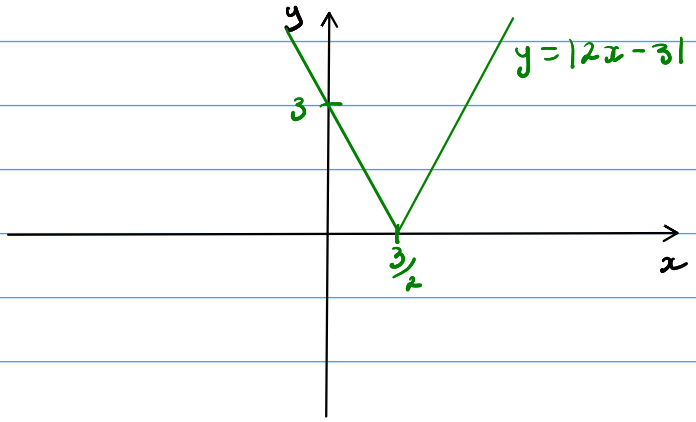
$$y = |2x - 3|$$

stating the coordinates where the graph meets the coordinate axis. **(2)**

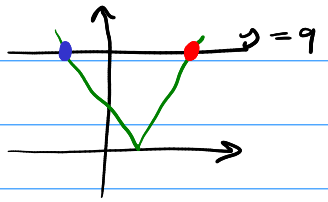
(b) Find the values of x which satisfy $|2x - 3| < 9$ **(2)**

(c) Find the values of x which satisfy $|2x - 3| < x + 1$ **(2)**

a)



b)



$-(2x - 3) = 9$

$2x - 3 = -9$

$2x = -6$

$x = -3$

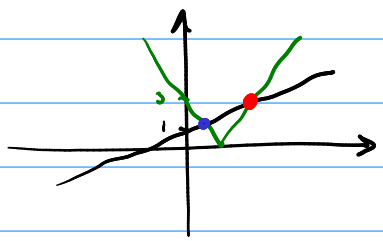
$2x - 3 = 9$

$2x = 12$

$x = 6$

$-3 < x < 6$

c)



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

$-2x + 3 = x + 1$

$2 = 3x$

$x = \frac{2}{3}$

$2x - 3 = x + 1$

$x = 4$

$\frac{2}{3} < x < 4$

8 The functions f and g are defined by

$$f : x \to \ln(3x-2), \quad x \in \mathbb{R}, \ x > \frac{2}{3}$$

$$g : x \to \frac{3}{x-2}, \quad x \in \mathbb{R}, \ x \neq 2$$

(a) Find the exact value of fg(3) **(2)**

(b) Find an expression for $f^{-1}(x)$ and state its domain **(4)**

(c) Sketch the graphs of $f(x)$ and $f^{-1}(x)$ on the same diagram **(3)**

(d) Sketch the graph of $y = |g(x)|$ **(3)**

(e) Find the exact values of $\left|\frac{3}{x-2}\right| = 4$ **(3)**

a/ $g(3) = \frac{3}{3-2} = 3$

$f(3) = \ln(3(3)-2)$

$= \ln 7$

b/ $y = \ln(3x-2)$

$x = \ln(3y-2)$

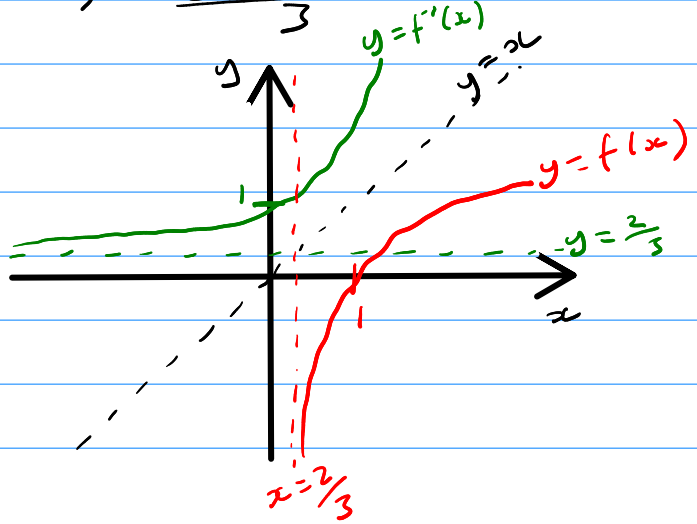
$e^x = 3y - 2$

$e^x + 2 = 3y$

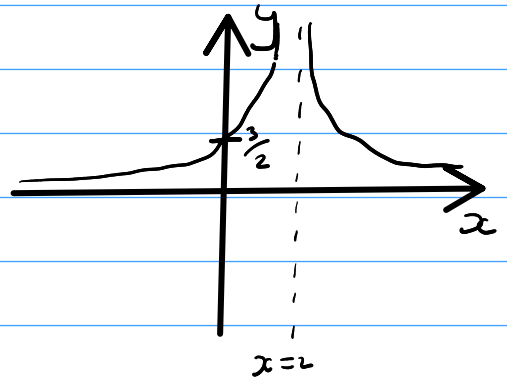
$y = \frac{e^x + 2}{3}$

$f^{-1}(x) = \frac{e^x + 2}{3}$

c/



d/



e/ $\frac{3}{x-2} = 4$ $\qquad$ $-\frac{3}{x-2} = 4$

$3 = 4(x-2)$ $\qquad$ $\frac{3}{x-2} = -4$

$3 = 4x - 8$ $\qquad$ $3 = -4(x-2)$

$11 = 4x$ $\qquad$ $3 = -4x + 8$

$x = \frac{11}{4}$ $\qquad$ $-5 = -4x$

$x = \frac{5}{4}$

9

$$f(x) = \frac{3x + 1}{x - 2} \qquad x \geq 4$$

(a) Find ff(4) **(2)**

(b) State the range of f. **(1)**

(c) Find $f^{-1}(x)$ and state its domain **(3)**

a/ $f(4) = \frac{3(4)+1}{4-2} = \frac{13}{2}$

$f\left(\frac{13}{2}\right) = \frac{3\left(\frac{13}{2}\right)+1}{\left(\frac{13}{2}\right)-2}$

$= \frac{41}{9}$

b/ when $x = 4$ $f(x) = \frac{13}{2}$

As x gets bigger $f(x)$ gets closer to 3.

$$3 < f(x) \leq \frac{13}{2}$$

c/ $y = \frac{3x+1}{x-2}$

$x = \frac{3y+1}{y-2}$

$x(y-2) = 3y + 1$

$xy - 2x = 3y + 1$

$xy - 3y = 1 + 2x$

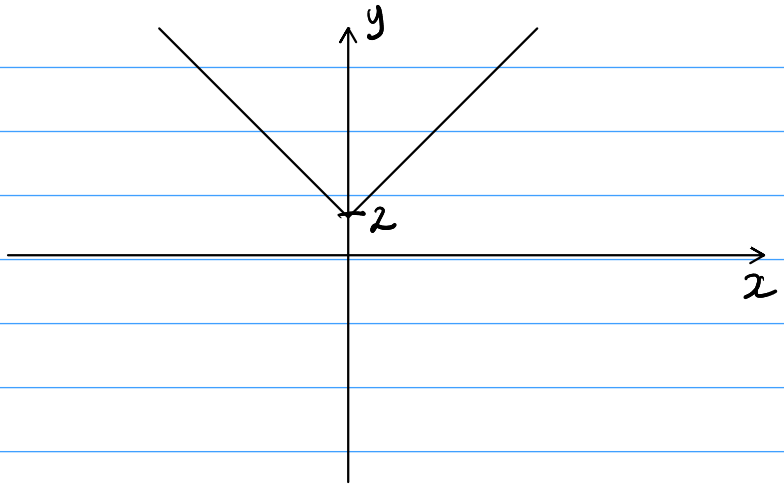
$y(x-3) = 1 + 2x$

$y = \frac{1+2x}{x-3}$

$$f^{-1}(x) = \frac{1+2x}{x-3} \qquad 3 < x \leq \frac{13}{2}$$

10 (a) (i) Sketch the graph of $y = |x| + 2$

(ii) Explain why $|x| + 2 \geq |x + 2|$ for all real values of x.



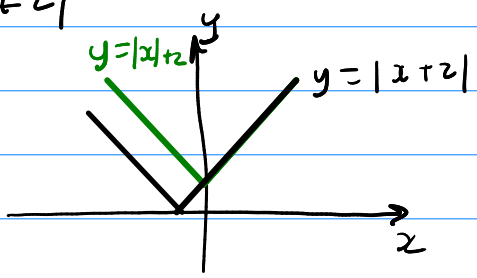
ii) when $x \geq 0$ $|x| + 2 = |x + 2|$

but when $x < 0$ eg $x = -2$

$|-2| + 2 = 4$

$|-2 + 2| = 0$

$|x| + 2 > |x + 2|$ for all negative values of x



11 $f(x) = 2x^2 + 8x + 11 \qquad x \in \mathbb{R}$

(a) Write f(x) in the form $a(x + b)^2 + c$, where a, b and c are integers to be found. **(3)**

(b) Sketch the curve with equation $y = f(x)$ showing any points of intersection with the coordinate axes and the coordinates of any turning point. **(3)**

(c) Describe fully the transformation that maps the curve with equation $y = f(x)$ onto the curve with equation $y = g(x)$ where **(2)**

$$g(x) = 2(x - 2)^2 + 8x - 5 \qquad x \in \mathbb{R}$$

(d) Find the range of the function **(2)**

$$h(x) = \frac{18}{2x^2 + 8x + 11} \qquad x \in \mathbb{R}$$

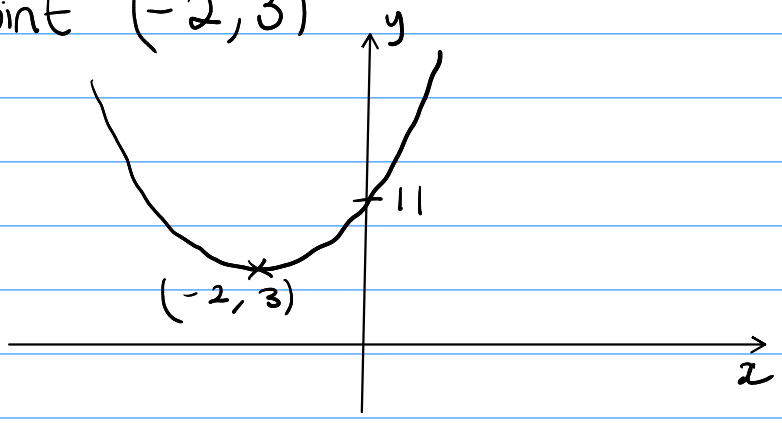
a/ $2(x^2 + 4x) + 11$

$2[(x + 2)^2 - 4] + 11$

$2(x + 2)^2 - 8 + 11$

$2(x + 2)^2 + 3$

b/ min point $(-2, 3)$



c/ $f(x-2) = 2(x-2)^2 + 8(x-2) + 11$

$= 2(x-2)^2 + 8x - 16 + 11$

$= 2(x-2)^2 + 8x - 5$

Translation 2 to the right $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$

d/ Range of $f(x)$: $f(x) \geq 3$ $\quad \frac{18}{3} = 6$

As x gets bigger $h(x)$ gets closer to zero

$\therefore \quad 0 < h(x) \leq 6$

12 The function f is defined by

$$f(x) = \frac{3x - 5}{x - 2}, \qquad x \in \mathbb{R},\ x \neq 2$$

(a) Find $f^{-1}(4)$ **(2)**

(b) Show that $ff(x) = \frac{ax + b}{x - 1}$ where a and b are integers to be found. **(3)**

a/ $4 = \frac{3x - 5}{x - 2}$

$4(x-2) = 3x - 5$

$4x - 8 = 3x - 5$

$x = 3$

b/ $f\left(\frac{3x-5}{x-2}\right) = \frac{3\left(\frac{3x-5}{x-2}\right) - 5}{\frac{3x-5}{x-2} - 2}$

$= \frac{3(3x-5) - 5(x-2)}{3x - 5 - 2(x-2)}$

$= \frac{9x - 15 - 5x + 10}{3x - 5 - 2x + 4}$

$= \frac{4x - 5}{x - 1}$

---

13 The function f is defined by $f(x) = e^{x+1}$, $x \in \mathbb{R}$

Find $f^{-1}(x)$ and state its domain.

range: $f(x) > 0$

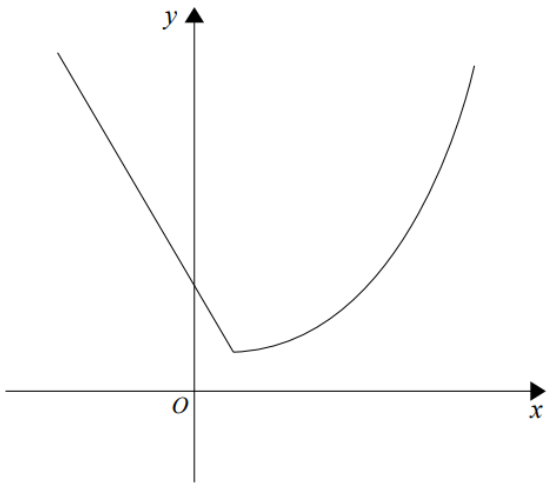
$y = e^{x+1}$

$x = e^{y+1}$

$\ln x = y + 1$

$y = \ln x - 1$

$f^{-1}(x) = \ln x - 1$ $\qquad x > 0$



The diagram shows a sketch of $y = g(x)$, where

$$g(x) = \begin{cases} 5 - 3x & x < 1 \\ (x-1)^2 + 2 & x \geq 1 \end{cases}$$

(a) Find the value of gg(0) **(2)**

(b) Find all the values of x for which $g(x) > 18$ **(4)**

The function h is defined as

$$h(x) = (x-1)^2 + 2 \qquad x \geq 1$$

(c) Explain why h has an inverse but g does not. **(1)**

(d) Solve the equation

$$h^{-1}(x) = 2$$

(3)

a/ $g(0) = 5 - 3(0) = 5$

$g(5) = (5-1)^2 + 2 = 18$

b/ $5 - 3x = 18$

$-13 = 3x$

$x = -\frac{13}{3}$

$(x-1)^2 + 2 = 18$

$(x-1)^2 = 16$

$x - 1 = \pm 4$

$x = -3$ (×) or 5

$x < -\frac{13}{3}$ or $x > 5$

c/ h is one to one function but g is a many to one function.

d/ $(2-1)^2 + 2 = 3$

15

$$f(x) = \frac{2x + 1}{x - 1} \qquad x \neq 1$$

(a) Find $f^{-1}(x)$ **(3)**

(b) Find an expression for $ff(x)$ **(1)**

a/ $y = \frac{2x+1}{x-1}$

$x = \frac{2y+1}{y-1}$

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

$xy - x = 2y + 1$

$xy - 2y = 1 + x$

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

$y = \frac{1+x}{x-2}$

$f^{-1}(x) = \frac{x+1}{x-2}$

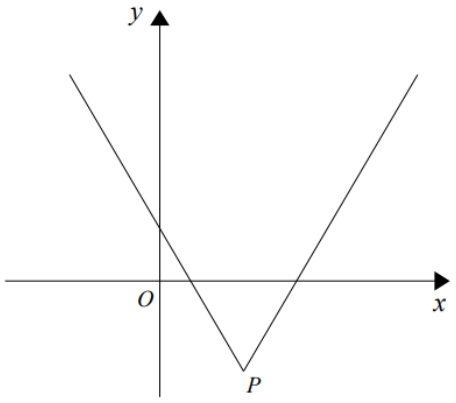
b/ $f\left(\frac{2x+1}{x-1}\right) = \frac{2\left(\frac{2x+1}{x-1}\right) + 1}{\left(\frac{2x+1}{x-1}\right) - 1}$ $\times(x-1)$ $x(x-1)$

$= \frac{2(2x+1) + (x-1)}{2x+1 - (x-1)}$

$= \frac{4x + 2 + x - 1}{2x + 1 - x + 1}$

$= \frac{5x + 1}{x + 2}$

16



The diagram shows a sketch of $y = 2|x-3|-5$

The vertex of the graph is at point P.

(a) Find the coordinates of point P. **(2)**

(b) Solve the equation $10 - x = 2|x-3|-5$ **(2)**

A line l has equation $y = ax$, where a is a constant.

Given that l intersects $y = 2|x-3|-5$ at least once,

(c) find the range of possible values of a, writing your answer in set notation. **(3)**

a) $y = 2|x-3|-5$

vertex when $x = 3$ $\quad y = 2(0) - 5$

$= -5$

$(3, -5)$

b) 2 intersections

$10 - x = 2(x-3) - 5$

$10 - x = 2x - 6 - 5$

$10 - x = 2x - 11$

$21 = 3x$

$x = 7$

$10 - x = -2(x-3) - 5$

$10 - x = -2x + 6 - 5$

$10 - x = -2x + 1$

$x = -9$

c) if $a = -2$ no intersection

the line $(0,0)$ $(3,-5)$ intersects once

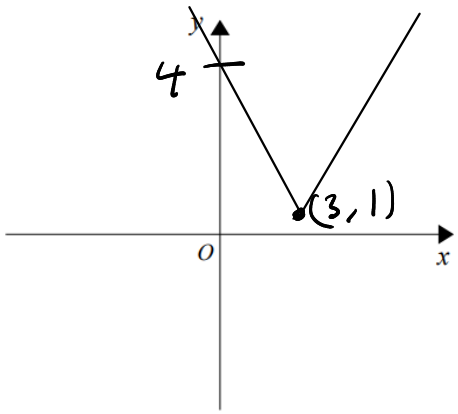
$x_1\ y_1$ $\quad x_2\ y_2$

$m = \frac{-5}{3}$

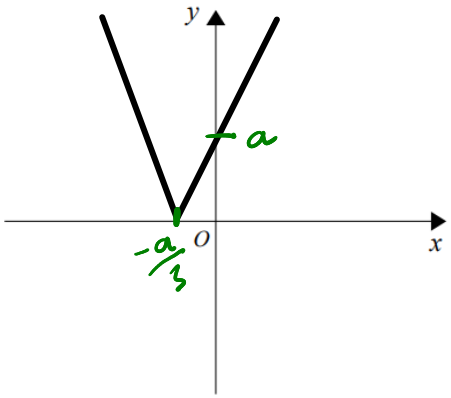
$\{a : -2 < a < -\frac{5}{3}\}$

17 Sketch the graph of $y = 1 + |x - 3|$

Show clearly where the graph intersects the axes.



18



Sketch the graph of $y = |3x + a|$, where a is a positive constant.

Show clearly where the graph intersects the axes.

19 The function f is defined by $f(x) = 2x^2 + 5, \ x \geq 0$

(a) Find the range of f. **(1)**

(b) Find $f^{-1}(x)$ **(3)**

(c) State the range of $f^{-1}(x)$ **(1)**

a/ $f(x) \geq 5$

b/ $y = 2x^2 + 5$

$y - 5 = 2x^2$

$\frac{y-5}{2} = x^2$

$x = \sqrt{\frac{y-5}{2}}$ $\quad f^{-1}(x) = \sqrt{\frac{x-5}{2}}$ $\quad x \geq 5$

c/ $f^{-1}(x) \geq 0$

20 $f(x) = \arcsin x$

State the maximum possible domain of f.

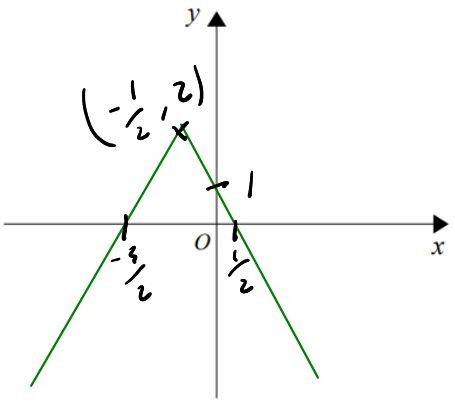
$-1 \leq x \leq 1$

21 $f(x) = \dfrac{1}{\sqrt{x+2}}$

State the maximum possible domain of f.

$x > -2$

22 (a) Sketch the graph of $y = 2 - |2x + 1|$



(3)

(b) Solve the inequality $2 - |2x + 1| > 0$ **(2)**

b/ $-\frac{3}{2} < x < \frac{1}{2}$

23 The function f is defined by $f(x) = 2x^2 - 3x \quad x \in \mathbb{R}, \ 0 \leq x \leq 4$

(a) Find the range of f. **(3)**

(b) Determine whether f has an inverse.
Fully justify your answer. **(2)**

a/ $f(x) = 2\left(x^2 - \frac{3}{2}x\right)$

$= 2\left(\left(x - \frac{3}{4}\right)^2 - \frac{9}{16}\right)$

$= 2\left(x - \frac{3}{4}\right)^2 - \frac{9}{8}$

min value of $f(x) = -\frac{9}{8}$ when $x = 4$ $f(x) = 2(4)^2 - 3(4)$
$= 20$

$-\frac{9}{8} \leq f(x) \leq 20$

b/ No. $f(x)$ is a many to one function $\therefore$ no inverse.

24 The function f is defined for all real values of x as $f(x) = x^2 - 6x + c$, where c is a constant.

(i) Given that the range of f is $f(x) \geq 2$, find the value of c. **(3)**

(ii) Given instead that $ff(2) = 12$, find the possible values of c. **(4)**

i/ $f(x) = (x-3)^2 - 9 + c$

$c = 11$

ii/ $f(2) = (2)^2 - 6(2) + c$

$= c - 8$

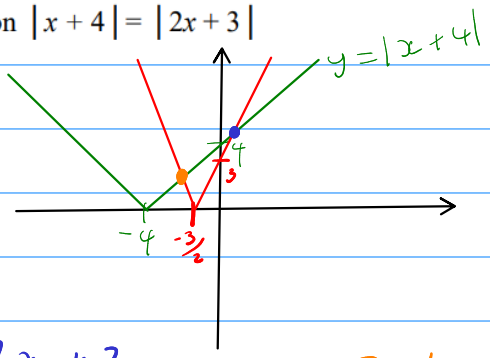
$(c-8)^2 - 6(c-8) + c = 12$

$c^2 - 16c + 64 - 6c + 48 + c = 12$

$c^2 - 21c + 100 = 0$

$c = \frac{21}{2} \pm \frac{\sqrt{41}}{2}$

25 Solve the equation $|x+4| = |2x+3|$



$x + 4 = 2x + 3$

$1 = x$

$x + 4 = -(2x + 3)$

$x + 4 = -2x - 3$

$3x = -7$

$x = -\frac{7}{3}$

$x = -\frac{7}{3}$ and $x = 1$

26 The functions f and g are defined for all real values of x by

$f(x) = x^3$ and $g(x) = x^2 - 1$

(a) Write down expressions for $fg(x)$ and $gf(x)$ **(2)**

(b) Hence find the values of x for which $gf(x) - fg(x) = 18$ **(6)**

a/ $fg(x) = (x^2 - 1)^3$

$gf(x) = (x^3)^2 - 1$

$= x^6 - 1$

b/ $x^6 - 1 - (x^2 - 1)^3 = 18$

$x^6 - 1 - (x^4 - 2x^2 + 1)(x^2 - 1) = 18$

$x^6 - 1 - (x^6 - x^4 - 2x^4 + 2x^2 + x^2 - 1) = 18$

$x^6 - 1 - x^6 + x^4 + 2x^4 - 2x^2 - x^2 + 1 = 18$

$3x^4 - 3x^2 = 18$

$3x^4 - 3x^2 - 18 = 0$

$x^4 - x^2 - 6 = 0$

$(x^2 - 3)(x^2 + 2) = 0$

$x^2 = 3$ $\times$

$x = \pm\sqrt{3}$

27 The function f is defined by $f(x) = (x-2)^2 - 9$ for $x \geq k$, where k is a constant.

(a) Given that $f^{-1}(x)$ exists, state the least possible value of k. **(1)**

(b) Evaluate ff(5) **(2)**

(c) Solve the equation $f(x) = x$ **(3)**

(d) Explain why your answer to part (c) is also the solution to the equation $f(x) = f^{-1}(x)$ **(1)**

a/ min point at $(2, -9)$

$\underline{\underline{2}}$

b/ $f(5) = 0$

$f(0) = \underline{\underline{-5}}$

c/ $(x-2)^2 - 9 = x$

$x^2 - 4x + 4 - 9 = x$

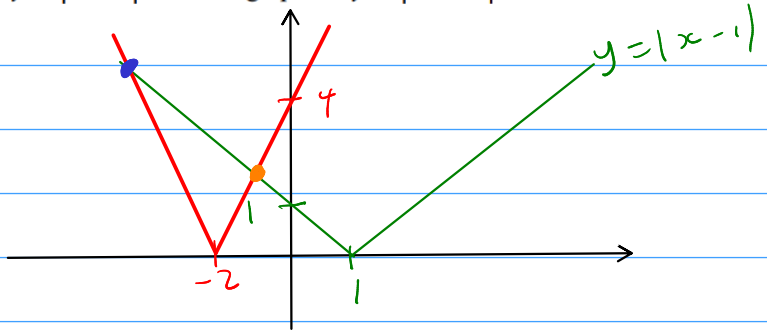
$x^2 - 5x - 5 = 0$

$x = \underline{\underline{\dfrac{5 + 3\sqrt{5}}{2}}}$ $\quad x = \dfrac{5 - 3\sqrt{5}}{2}$ ✗ as $x \geq 2$

d/ The graphs of $f(x)$ and $f^{-1}(x)$ reflect in the line $y = x$. ∴ Any point where $f(x)$ crosses $y = x$ $f^{-1}(x)$ will also cross $y = x$.

28 (a) Solve the inequality $|x-1| \leq |2x+4|$ **(4)**

(b) Give full details of a sequence of two transformations needed to transform the graph of $y = |x-1|$ onto the graph of $y = |2x+4|$ **(3)**



Intersections where:

$-(x-1) = -(2x+4)$

$-x+1 = -2x-4$

$x = -5$

$2x+4 = -(x-1)$

$2x+4 = -x+1$

$3x = -3$

$x = -1$

$x \leq -5$ or $x \geq -1$

b) 1) Stretch with scale factor $\frac{1}{2}$ in the x direction

2) Translation by vector $\begin{pmatrix} -2.5 \\ 0 \end{pmatrix}$

or 1) translation by vector $\begin{pmatrix} -5 \\ 0 \end{pmatrix}$

2) stretch with s.f $\frac{1}{2}$ in x direction

29 The functions f and g are defined for all real values of by

$f(x) = 2x^2 - 3x$ and $g(x) = 4x + 6$

(a) Find the range of f. **(3)**

(b) Give a reason why f has no inverse. **(1)**

(c) Given that $gf(2) = g^{-1}(a)$, where a is a constant, determine the value of a. **(3)**

(d) Determine the set of values for which $f(x) > g(x)$. Give your answer in set notation. **(3)**

a/ $f(x) = 2\left(x^2 - \frac{3}{2}x\right)$

$= 2\left[\left(x - \frac{3}{4}\right)^2 - \frac{9}{16}\right]$

$= 2\left(x - \frac{3}{4}\right)^2 - \frac{9}{8}$

$f(x) \geq -\frac{9}{8}$

b/ It is a many to one function (many to one functions do not have an inverse)

c/ $f(2) = 2(2)^2 - 3(2)$

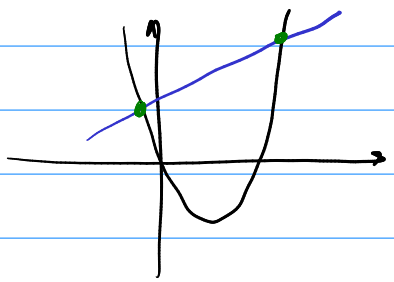
$= 2$

$g(2) = 4(2) + 6$

$= 14$

$g^{-1}(a) = 14$ $\quad g(14) = 4(14) + 6$

$= 62$



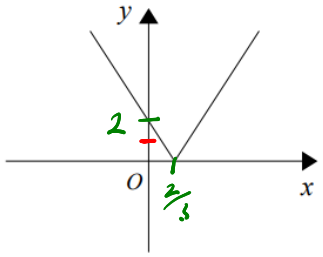
d/ $2x^2 - 3x = 4x + 6$

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

$x = \frac{7 + \sqrt{97}}{4}$ $\quad x = \frac{7 - \sqrt{97}}{4}$

$\left\{x : x < \frac{7-\sqrt{97}}{4}\right\} \cap \left\{x : x > \frac{7+\sqrt{97}}{4}\right\}$

30



The graph shows a sketch of $y = |3x - 2|$

(a) State the coordinates of the points of intersection with the axes. **(2)**

(b) Given that the graphs of $y = |3x - 2|$ and $y = ax + 1$ have two distinct points of intersection, determine

(i) the set of possible values of a, **(4)**
(ii) the x coordinates of the points of intersection of these graphs, giving your answers in terms of a. **(3)**

a/ $(0, 2)$ and $\left(\frac{2}{3}, 0\right)$

bi/ a must be less than 3

one intersection if $y = ax + 1$ goes through $\left(\frac{2}{3}, 0\right)$

$$0 = \frac{2}{3}a + 1$$
$$-1 = \frac{2}{3}a$$
$$a = -\frac{3}{2}$$

$$\therefore \quad -\frac{2}{3} < a < 3$$

ii/

$3x - 2 = ax + 1$
$3x = ax + 3$
$3x - ax = 3$
$x(3 - a) = 3$
$x = \frac{3}{3 - a}$

$-(3x - 2) = ax + 1$
$-3x + 2 = ax + 1$
$1 = ax + 3x$
$1 = x(a + 3)$
$x = \frac{1}{a + 3}$

31 The function $f(x) = \dfrac{e^x}{2 - e^x}$ is defined on the domain $x \in \mathbb{R}, x \neq \ln 2$

(a) Find $f^{-1}(x)$ **(3)**

(b) Write down the range of $f^{-1}(x)$ **(1)**

a/

$$y = \frac{e^x}{2 - e^x}$$

$$x = \frac{e^y}{2 - e^y}$$

$$x(2 - e^y) = e^y$$

$$2x - xe^y = e^y$$

$$2x = e^y + xe^y$$

$$2x = e^y(1 + x)$$

$$e^y = \frac{2x}{1 + x}$$

$$y = \ln\left(\frac{2x}{1 + x}\right)$$

$$f^{-1}(x) = \ln\left(\frac{2x}{1 + x}\right)$$

b/ $f^{-1}(x) \in R$, $f^{-1}(x) \neq \ln 2$

32 You are given that

$f(x) = x^2 - 4x - 5$ for $x > 2$ and
$g(x) = 2x + 1$

(a) Find $gf(x)$ and state its domain **(3)**

(b) State the range of $gf(x)$. **(1)**

(c) Find $gf^{-1}(x)$. **(5)**

a/ $gf(x) = 2(x^2 - 4x - 5) + 1$

$= 2x^2 - 8x - 10 + 1$

$= 2x^2 - 8x - 9$ $\quad x > 2$

b/ $2(2)^2 - 8(2) - 9 = -17$

$gf(x) > -17$

c/ $f^{-1}(x)$ $\quad y = (x-2)^2 - 4 - 5$

$y = (x-2)^2 - 9$

$x = (y-2)^2 - 9$

$x + 9 = (y-2)^2$

$\pm\sqrt{x+9} = y - 2$

$y = 2 \pm \sqrt{x+9}$

we only want the positive root $f^{-1}(x) = 2 + \sqrt{x+9}$

$x > -9$

$gf^{-1}(x) = 2(2 + \sqrt{x+9}) + 1$

$= 4 + 2\sqrt{x+9} + 1$

$= 5 + 2\sqrt{x+9}$ $\quad x > -9$

33 The function f is defined for all real values of by

$f(x) = 2x - 5$

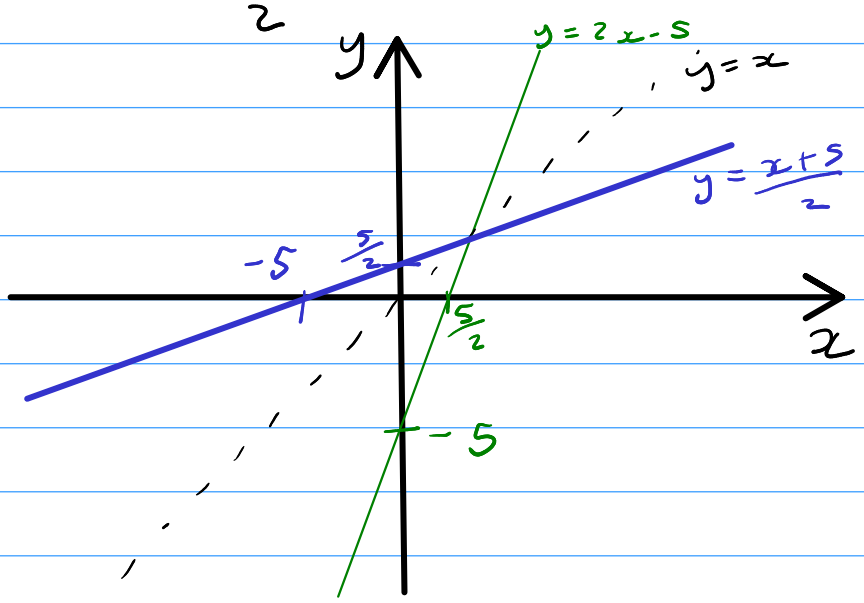
(a) Find an expression for $f^{-1}(x)$ **(2)**

(b) Sketch the graphs of $y = f(x)$ and $y = f^{-1}(x)$ on the same diagram. **(2)**

(c) Find the set of values for which $f(x) > f^{-1}(x)$. **(2)**

a/ $f^{-1}(x) = \frac{x+5}{2}$

b/

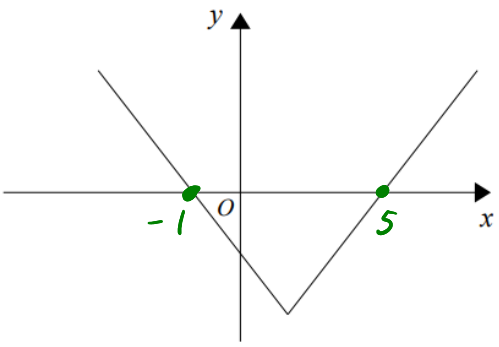


c/ Intersection where $2x - 5 = x$

$x = 5$

$x > 5$

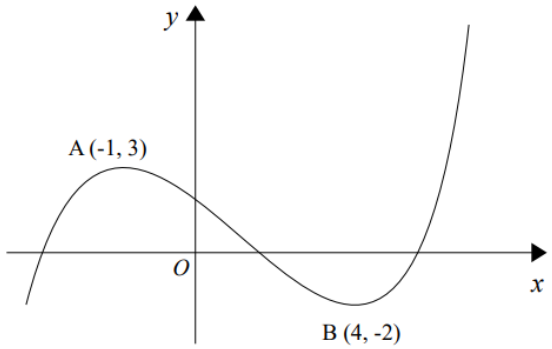
34 The graph shows a sketch of $y = |x - 2| - 3$



Find the set of values for which $|x - 2| < 3$

$\{x : x > -1\} \cup \{x : x < 5\}$

35 The diagram shows the graph of $y = f(x)$



The curve has a maximum point A (-1, 3) and a minimum point B (4, -2).

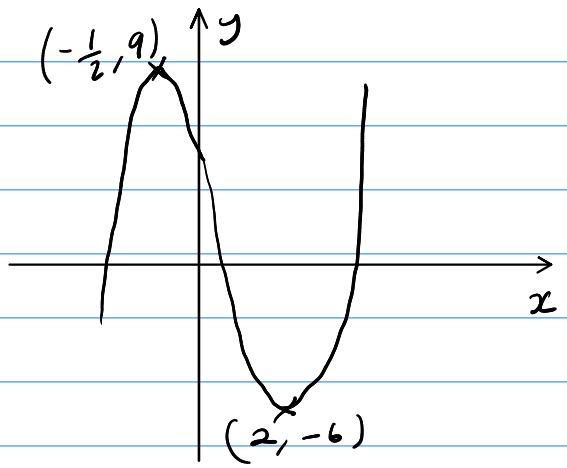
Showing the coordinates of any stationary points, on separate diagrams sketch the graphs of

(a) $y = 3f(2x)$ **(3)**

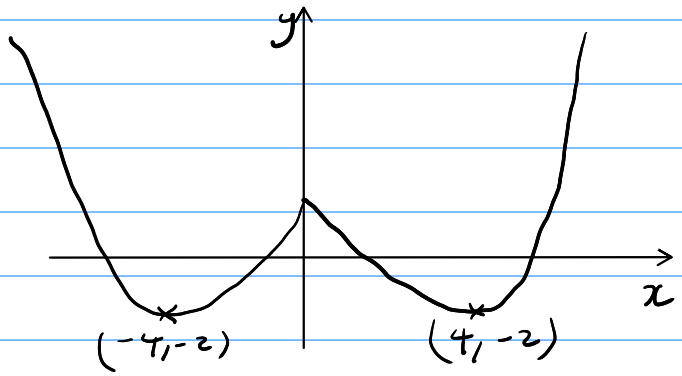
(b) $y = f(|x|)$ **(3)**

(c) Write down the constants a and b such that the curve with equation $y = f(x + a) + b$ has a minimum point at the origin O. **(2)**

a/



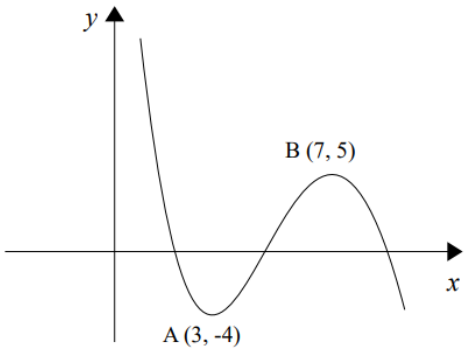
b/



c/ $a = 4 \quad b = 2$

$f(x + 4) + 2$

36 The diagram shows the graph of $y = f(x)$



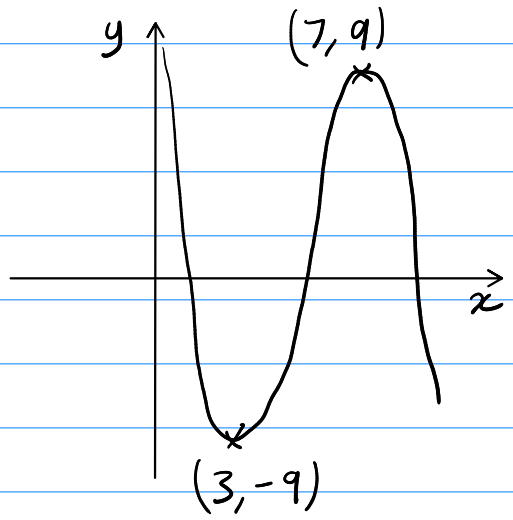
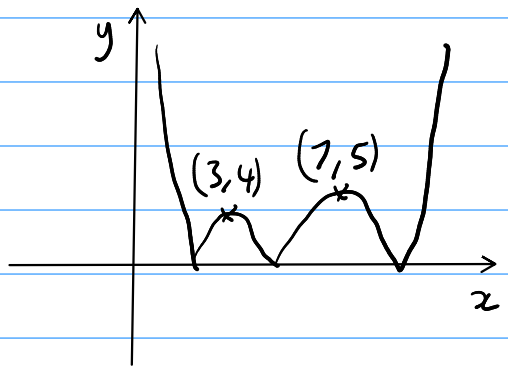
The points A (3, -4) and B (7, 5) are the turning points of the graph.

On separate diagrams sketch the graphs of

(a) $y = 2f(x) - 1$ **(3)**

(b) $y = |f(x)|$ **(3)**

a/



b/