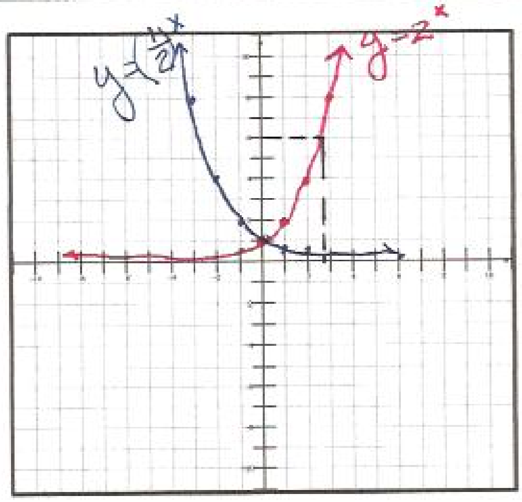
1. **(a)** Graph on the same set of axes.

$y = 2^x$ $\qquad$ $y = \left(\frac{1}{2}\right)^x$



(b) Using your graph, determine the solution to $2^x = 6$. **Show the solution clearly on your graph.**

$x \approx 2.6$

2. Determine the exact solution(s) for each equation.

(a) $\frac{1}{x^2} = 9 - x$

$\{-.327, .340, 8.99\}$

(b) $2x - 2^x = x - 3$

$\{-2.86, 2.44\}$

3. Mr. Jones wants to put a 100 m long fence around his rectangular garden. He only needs to fence in 3 sides because the other side is alongside his barn.

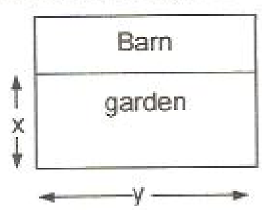


diagram not to scale

$2x + y = 100$

The width of the garden is denoted by x, and the length by y.

(a) Write an expression for y ***in terms of*** x.

$y = 100 - 2x$

(b) Write an expression for the area, A, of the garden, in terms of x.

$A = xy$ $\qquad$ $A = x(100-2x)$

(c) If the area is 800 m^2, find the dimensions of the garden.

$800 = x(100-2x)$

$800 = 100x - 2x^2$

$2x^2 - 100x + 800 = 0$

$x = 10$ $\qquad$ $x = 40$

$\boxed{10\text{m} \times 80\text{m}}$ $\qquad$ $\boxed{40\text{m} \times 20\text{m}}$

4. Consider the graphs of the following functions.

(i) $y = 7x + x^2$;
(ii) $y = (x - 2)(x + 3)$;
(iii) $y = 3x^2 - 2x + 5$;
(iv) $y = 5 - 3x - 2x^2$.

Which of these graphs (use the number (i), (ii), (iii), or (iv) to answer)

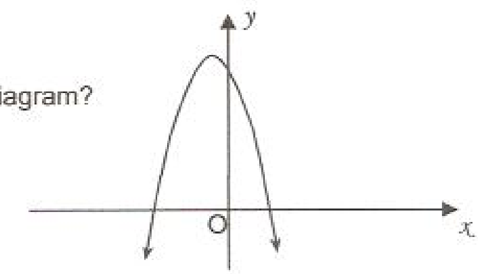
(a) has a y-intercept below the x-axis? ii

(b) passes through the origin? i

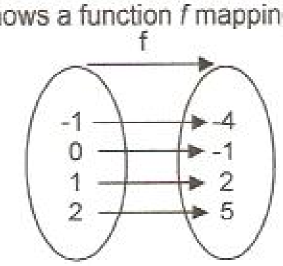
(c) does not cross the x-axis? iii

(d) could be represented by the following diagram?

iv



5. **(a)** The mapping diagram shows a function *f* mapping members of a set X to members of set Y.



(i) Using set notation, write down the members of the domain and range.

D: $\{x \mid x \in -1, 0, 1, 2\}$ R: $\{y \mid y \in -4, -1, 2, 5\}$

(ii) Find the equation of the function f.

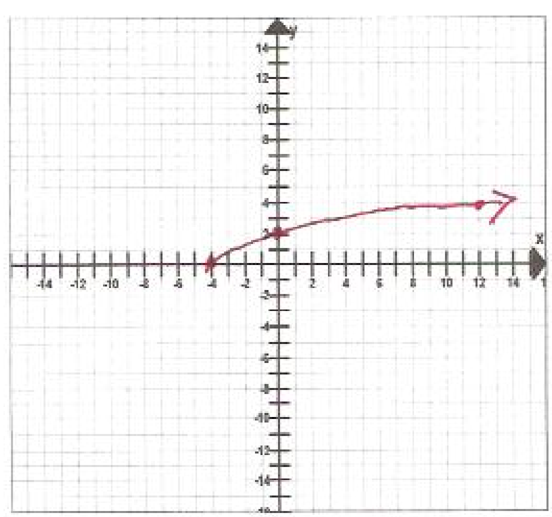
$y = 3x - 1$

6. A function *f* is defined as $f(x) = \sqrt{x+4}$ for $-4 \le x \le 12$, $x \in \Re$.

(a) Calculate: (i) $f(-4)$ (i) $f(0)$ (i) $f(12)$

0 2 4

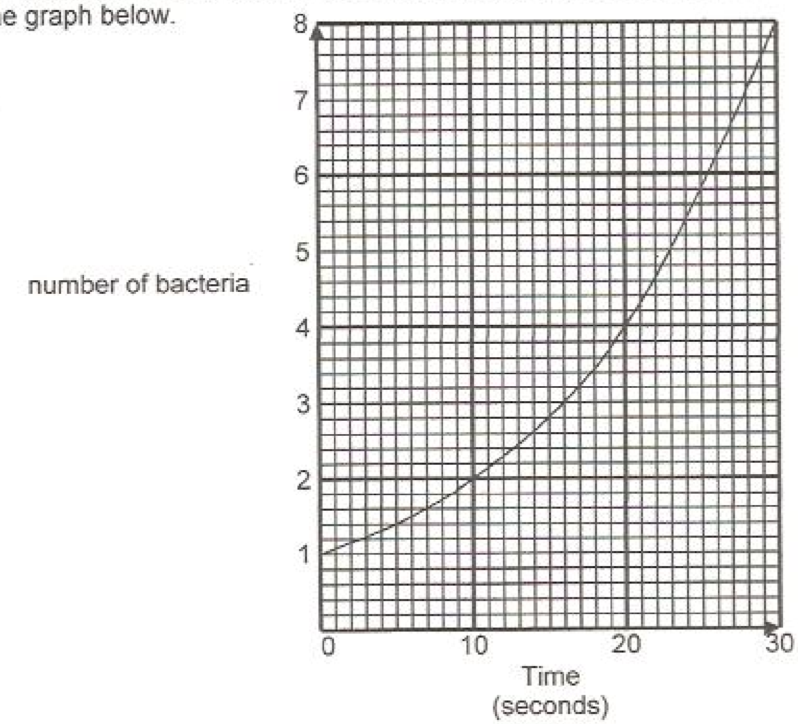
(b) Graph $y = f(x)$



(c) Hence, write down the range of $f(x)$.

$[0, 4]$

7. Under certain conditions the number of bacteria in a particular culture doubles every 10 seconds as shown by the graph below.



(a) Complete the table below.

Time (seconds)	0	10	20	30
Number of bacteria	1	2	4	8

(b) Calculate the number of bacteria in the culture after 1 minute.

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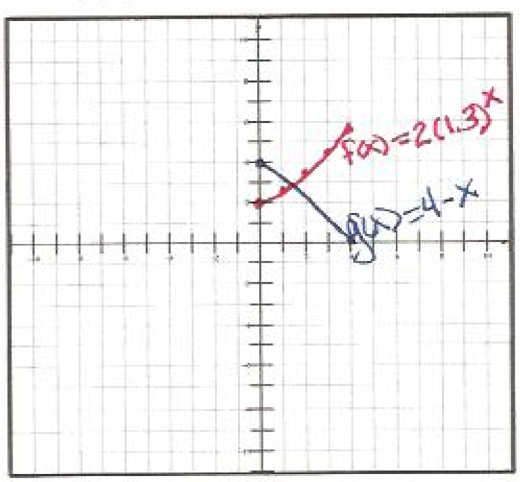
8. **(a)** On the grid below sketch the graph of the function $f(x) = 2(1.3)^x$ for the domain $0 \le x \le 4$.



(b) Write down the coordinates of the y-intercept of the graph of $y = f(x)$. (0,2)

(c) On the grid draw the graph of $g(x) = 4 - x$ for the domain $0 \le x \le 4$. see graph

(b) Use your graphic display calculator to solve $f(x) = g(x)$. $x = 1.23$

9. A liquid is heated so that after 15 seconds of heating its temperature, T, is 20°C and after 45 seconds of heating its temperature is 32°C.

The temperature of the liquid at time t can be modeled by $T = at + b$, where t is the time in seconds after the start of heating.

Using this model, one equation that can be formed is $15a + b = 20$.

(a) Using the model, write down a second equation in a and b.

$45a + b = 32$

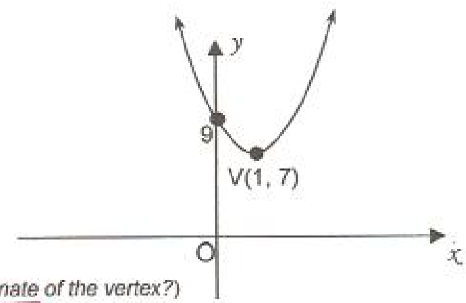
(b) Using your graphic display calculator or otherwise, find the value of a and of b.

$\left[\begin{array}{cc|c} 15 & 1 & 20 \\ 45 & 1 & 32 \end{array}\right]$ $\quad 15a+b=20$, $45a+b=32$ $\quad a=\frac{2}{5}$, $b=14$

(c) Use the model to predict the temperature of the liquid 60 seconds after the start of heating.

$T=\frac{2}{5}\cancel{t}+14 \quad T=\frac{2}{5}(60)+14$
$=38°C$

10. A graph of the quadratic $y = ax^2 + bx + c$ is shown alongside including the vertex, V, and the y-intercept.



(a) Determine the value of c.

$9=a(0)^2+b(0)+c$
$9=c$

(b) Use the axis of symmetry to write an equation involving a and b.
(Hint: Think of the x-coordinate of the vertex…What is the formula for the x-coordinate of the vertex?)

$x=-\frac{b}{2a} \quad 1=-\frac{b}{2a} \quad 2a=-b \quad \boxed{2a+b=0}$

(c) Use the point (1, 7) to write a second equation involving a and b.

$7=a(1)^2+b(1)+9 \quad \boxed{a+b=-2}$
$7=a+b+9$

(d) Find a and b.

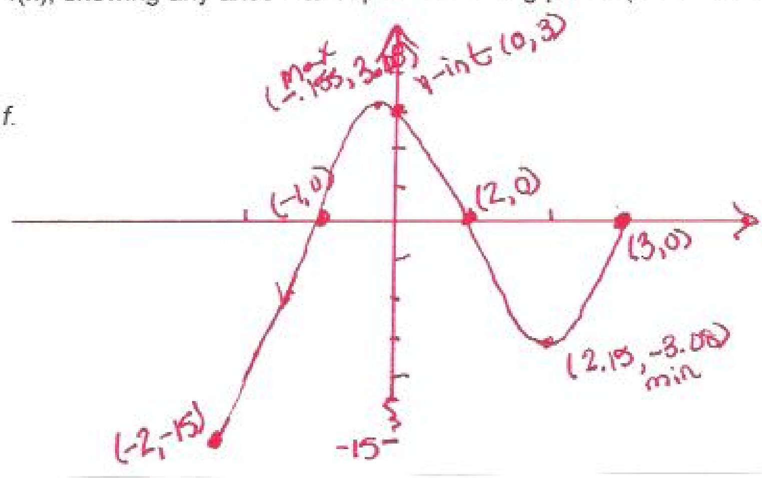
$2a+b=0$
$a+b=-2$
$\boxed{a=2,\ b=-4}$

11. Consider the function $f(x) = x^3 - 3x^2 - x + 3$, where f is defined on the domain $-2 \leq x \leq 3$, $x \in \Re$.

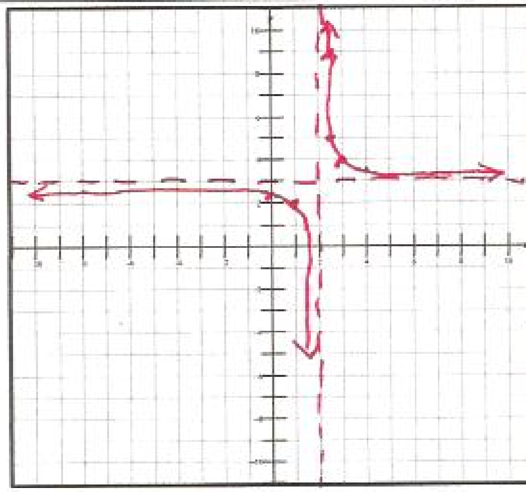
(a) **Sketch** the graph of $y = f(x)$, showing any axes intercepts and turning points (label coordinates).

(b) Determine the range of f.

$-15 \leq y \leq 3.08$



12. Consider the function $y = 3 + \dfrac{1}{x-2}$.



(a) Draw the graph of the function.

(b) Write down the equations of the vertical and horizontal asymptotes.

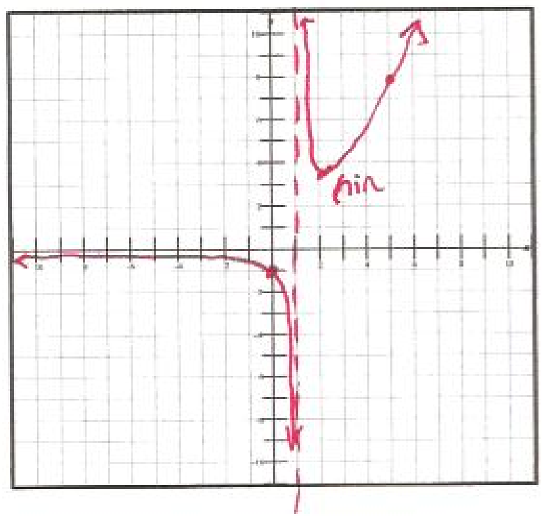
vertical $x=2$ horizontal $y=3$

(c) Write down the domain and range of the function using interval notation.

Domain: $(-\infty,2)\cup(2,\infty)$

Range: $(-\infty,3)\cup(3,\infty)$

13. Consider the function $f(x) = \dfrac{2^x}{x-1}$.



(a) Find the y-intercept.

$y = \dfrac{2^0}{0-1} = \dfrac{1}{-1} = -1$

(b) Determine the minimum value of $f(x)$ for $x \geq 1$.

3.77

(c) Write down the equation of the vertical asymptote.

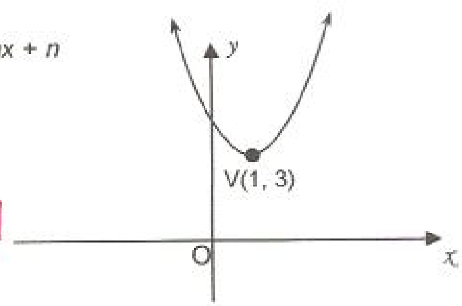
$x=1$

(d) Calculate $f(5)$.

$f(5) = \dfrac{2^5}{5-1} = \dfrac{32}{4} = 8$

(e) Draw the graph of $y = f(x)$, showing all features found above.

14. The diagram shows the graph of the quadratic function $f(x) = x^2 - mx + n$ including the vertex, V.



(a) Determine the values of m and n.

$x = -\dfrac{b}{2a}$ $\quad 1 = \dfrac{-(-m)}{2(1)}$ $\quad \boxed{m=2}$

$3 = (1)^2 - 2(1) + n$
$3 = 1 - 2 + n$
$3 = -1 + n$ $\quad \boxed{n=4}$

(b) Find k given that the graph passes through the point $(3, k)$.

$k = (3)^2 - 2(3) + 4$
$k = 9 - 6 + 4$ $\quad \boxed{k=7}$

(c) Find the domain and range of $f(x)$.

D: $(-\infty, \infty)$
R: $[3, \infty)$

15. Consider the function $h(x) = x^2 - 2^{-x} + \frac{1}{x}$.

(a) Determine $h(-2)$.

$h(-2) = (-2)^2 - 2^{-(-2)} + \frac{1}{-2} = -.5$

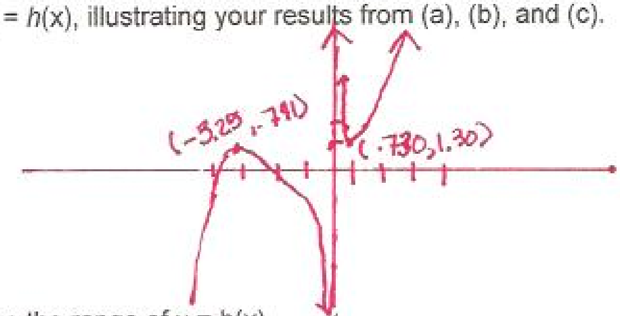
(b) Solve $h(x) = 2$.

$2 = x^2 - 2^{-x} + \frac{1}{x}$ $\{0.381, 1.28)$

(c) Write down the equation of the vertical asymptote.

$x = 0$

(d) Sketch y = h(x), illustrating your results from (a), (b), and (c).



(e) Determine the range of y = h(x).

$(-\infty, 0.741) \cup (1.30, \infty)$