

# ch 4 + 5 Misc Review Problems

3. The Smiths are looking for a plumber. They find this advert in the local paper.

The total charge,  $C$ , for plumbing services can be written as:

$$C = a + bx$$

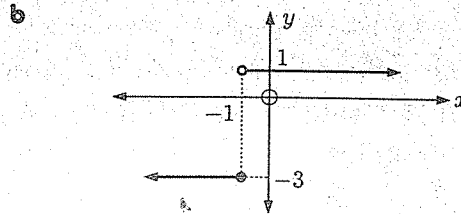
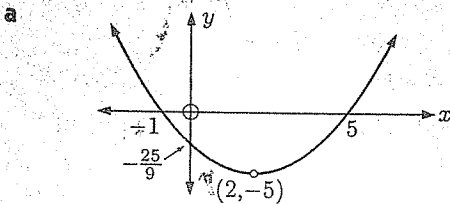
where  $x$  is the number of hours taken to finish the work.

Sydney Plumber  
\$140 call out + \$98 per hour

- State the values of  $a$  and  $b$ .
- How much will it cost the Smiths if it takes 5 hours to complete the work?
- In his next call out, the plumber charged Mr Jones \$826. How long did the plumber work on this job?

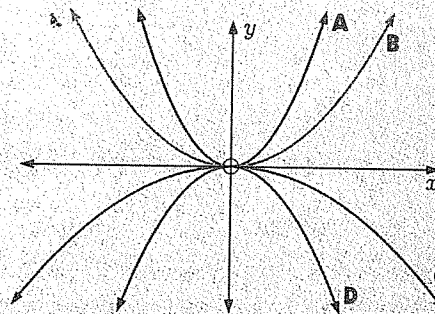
4. For each of the following graphs determine:

- the domain and range
- the  $x$  and  $y$ -intercepts
- whether it is a function.

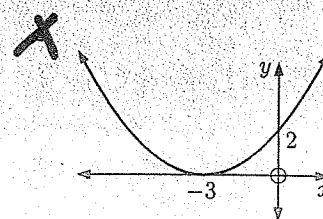
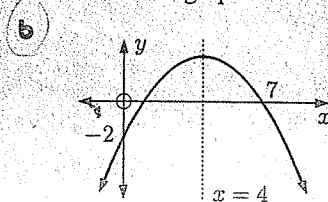
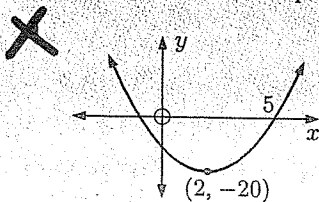


6. Match the function with the correct graph:

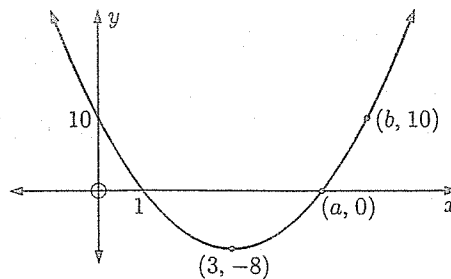
- $y = x^2$
- $y = -\frac{1}{2}x^2$
- $y = 3x^2$
- $y = -2x^2$



5. Find the equation of the quadratic function with graph:

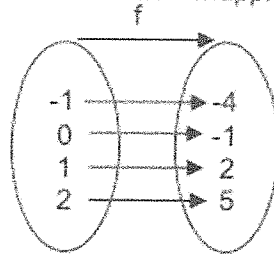


7. Determine the values of  $a$  and  $b$ :



## Ch 4 & 5 Misc Review Problems

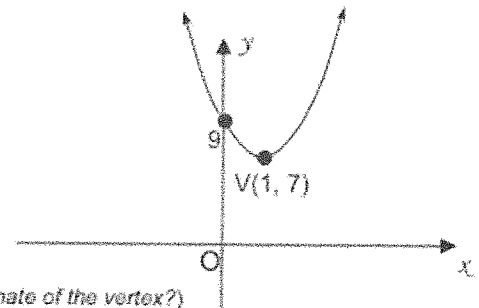
8. (a) The mapping diagram shows a function  $f$  mapping members of a set  $X$  to members of set  $Y$ .



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

(ii) Find the equation of the function  $f$ .

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  $c$ .

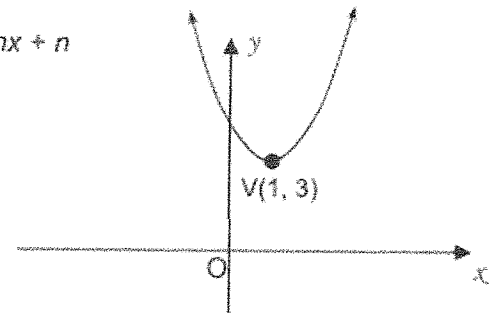
(b) Use the axis of symmetry to write an equation involving  $a$  and  $b$ .

(Hint: Think of the  $x$ -coordinate of the vertex...What is the formula for the  $x$ -coordinate of the vertex?)

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

(d) Find  $a$  and  $b$ .

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  $n$ .

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

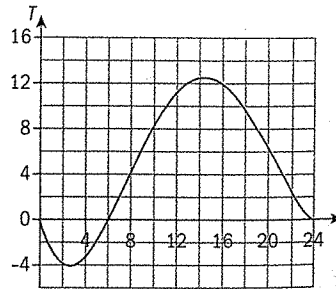
(c) Find the domain and range of  $f(x)$ .

# Ch 4 & 5 Review Problems

## Paper 1 style questions

### EXAM-STYLE QUESTIONS

- 1 The graph represents the temperature in  $^{\circ}\text{C}$  in a certain city last Tuesday.
- Write down the interval of time in which the temperature was below  $0^{\circ}\text{C}$ .
  - Write down the interval of time in which the temperature was above  $11^{\circ}\text{C}$ .
  - Write down the maximum temperature last Tuesday. Give your answer correct to the nearest unit.



- 2 The cost  $c$ , in Singapore dollars (SGD), of renting an apartment for  $n$  months is a linear model

$$c = nr + s$$

where  $s$  is the security deposit and  $r$  is the amount of rent per month.

Wan Ning rented the apartment for 6 months and paid a total of 35 000 SGD.

Tanushree rented the same apartment for 2 years and paid a total of 116 000 SGD.

Find the value of

- $r$ , the rent per month
- $s$ , the security deposit.

- 3 Given that  $f(x) = x^2 + 5x$

- factorize  $x^2 + 5x$
- sketch the graph of  $y = f(x)$ . Show on your sketch
  - the coordinates of the points of intersection with the axes
  - the equation of the axis of symmetry
  - the coordinates of the vertex of the parabola.

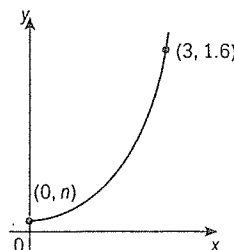
- 4 A signal rocket is fired vertically from ground level by a gun. The height, in metres, of the rocket above the ground is a function of the time  $t$ , in seconds, and is defined by:

$$h(t) = 30t - 5t^2, \quad 0 \leq t \leq 6.$$

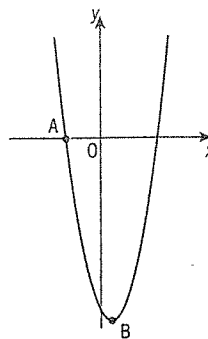
- Find the height of the rocket above the ground after 4 seconds.
- Find the maximum height of the rocket above the ground.
- Use your GDC to find the length of time, in seconds, for which the rocket is at a height of 25 m or more above the ground.

- 5 The graph of the function  $f(x) = \frac{2^x}{m}$  passes through the points  $(3, 1.6)$  and  $(0, n)$ .

- Calculate the value of  $m$ .
- Calculate the value of  $n$ . Find  $f(2)$ .



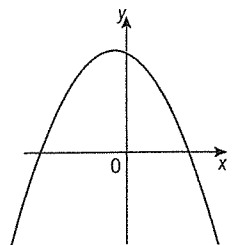
- 6 The diagram shows the graph of  $y = x^2 - 2x - 15$ .  
The graph crosses the  $x$ -axis at the point A, and has a vertex at B.
- Factorize  $x^2 - 2x - 15$ .
  - Find the coordinates of the point
    - A
    - B.



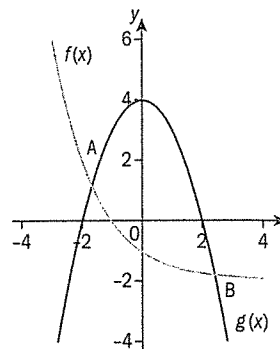
- 7 Consider the graphs of the following functions.
- $y = 8x + x^2$
  - $y = (x - 3)(x + 4)$
  - $y = x^2 - 2x + 5$
  - $y = 5 - 4x - 3x^2$

Which of these graphs

- has a  $y$ -intercept below the  $x$ -axis
- passes through the origin
- does not cross the  $x$ -axis
- could be represented by this diagram?



- 8 The figure shows the graphs of the functions  
 $f(x) = (0.5)^x - 2$  and  $g(x) = -x^2 + 4$   
for values of  $x$  between  $-3$  and  $3$ . The two graphs meet at the points A and B.
- Find the coordinates of
    - A
    - B.
  - Write down the set of values of  $x$  for which  $f(x) < g(x)$ .
  - Write down the equation of the horizontal asymptote to the graph of  $f(x)$ .



- 9 Gabriel is designing a rectangular window with a perimeter of 4.40 m. The length of the window is  $x$  m.
- Find an expression for the width of the window in terms of  $x$ .
  - Find an expression for the area of the window,  $A$ , in terms of  $x$ .

Gabriel wants to make the amount of light passing through this window a maximum.

- Find the value of  $x$  that meets this condition.

- 10 a On the same graph sketch the curves  $y = 3x^2$  and  $y = \frac{1}{x}$  for values of  $x$  from  $-4$  to  $4$  and values of  $y$  from  $-4$  to  $4$ .
- Write down the equations of the vertical and horizontal asymptotes of  $y = \frac{1}{x}$ .
  - Solve the equation  $3x^2 - \frac{1}{x} = 0$ .

EXAM-STYLE QUESTIONS

- 1 The number ( $n$ ) of bacteria after  $t$  hours is given by the formula  $n = 1500(1.32)^t$ .
- a Copy and complete the table below for values of  $n$  and  $t$ .

Time ( $t$ hours)	0	1	2	3	4
Number of bacteria ( $n$ )	1500		2613	3450	

- b On graph paper, draw the graph of  $n = 1500(1.32)^t$ . Use a scale of 2 cm to represent 1 hour on the horizontal axis and 2 cm to represent 1000 bacteria on the vertical axis. Label the graph clearly.
- c Find
- the number of bacteria after 2 hours 30 minutes. Give your answer to the nearest ten bacteria.
  - the time it will take to form approximately 5000 bacteria. Give your answer to the nearest 10 minutes.

- 2 The functions  $f$  and  $g$  are defined by

$$f(x) = \frac{4}{x}, x \in \mathbb{R}, x \neq 0$$

$$g(x) = 2x, x \in \mathbb{R}$$

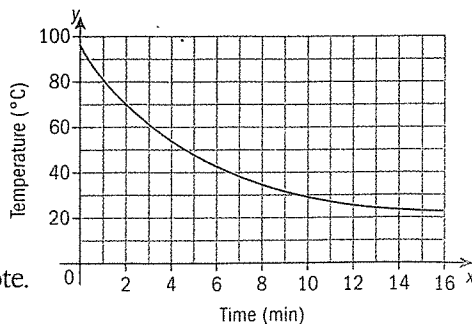
- Sketch the graph of  $f(x)$  for  $-8 \leq x \leq 8$ .
- Write down the equations of the horizontal and vertical asymptotes of the function  $f$ .
- Sketch the graph of  $g$  on the same axes.
- Find the solutions of  $\frac{4}{x} = 2x$ .
- Write down the range of function  $f$ .

- 3 A function is represented by the equation  $f(x) = 2(1.5)^x + 3$ . The table shows the values of  $f(x)$  for  $-3 \leq x \leq 2$ .

$x$	-3	-2	-1	0	1	2
$f(x)$	3.59	3.89	$a$	5	6	$b$

- Calculate the values for  $a$  and  $b$ .
- On graph paper, draw the graph of  $f(x)$  for  $-3 \leq x \leq 2$ , taking 1 cm to represent 1 unit on both axes. The domain of the function  $f(x)$  is the real numbers,  $\mathbb{R}$ .
- Write down the range of  $f(x)$ .
- Find the approximate value for  $x$  when  $f(x) = 10$ .
- Write down the equation of the horizontal asymptote of  $f(x) = 2(1.5)^x + 3$ .

- 4 The graph shows the temperature, in degrees Celsius, of Leonie's cup of hot chocolate  $t$  minutes after pouring it. The equation of the graph is  $f(t) = 21 + 77(0.8)^t$  where  $f(t)$  is the temperature and  $t$  is the time in minutes after pouring the hot chocolate out.



- Find the initial temperature of the hot chocolate.
- Write down the equation of the horizontal asymptote.
- Write down the room temperature.
- Find the temperature of the hot chocolate after 8 minutes.

5 Consider the functions

$$f(x) = x^2 - x - 6 \quad \text{and} \quad g(x) = -2x + 1$$

- On the same diagram draw the graphs of  $f(x)$  and  $g(x)$  for  $-10 \leq x \leq 10$ .
- Find the coordinates of the local minimum of the graph of  $f(x)$ .
- Write down the gradient of the line  $g(x)$ .
- Write down the coordinates of the point where the graph of  $g(x)$  cuts the  $y$ -axis.
- Find the coordinates of the points of intersection of the graphs of  $f(x)$  and  $g(x)$ .
- Hence, or otherwise, solve the equation  $x^2 + x - 7 = 0$ .

6 a Sketch the graph of  $f(x) = x^2 - \frac{3}{x}$ , for  $-4 \leq x \leq 4$ .

- Write down the equation of the vertical asymptote of  $f(x)$ .
- On the same diagram draw the graph of  $g(x) = -3(2)^x + 9$ , for  $-4 \leq x \leq 4$ .
- Write down the equation of the horizontal asymptote of  $g(x)$ .
- Find the coordinates of the points of intersection of  $f(x)$  and  $g(x)$ .

7 The profit ( $P$ ) in euros made by selling homemade lemonade is modeled by the function

$$P = -\frac{x^2}{10} + 10x - 60$$

where  $x$  is the number of glasses of lemonade sold.

a Copy and complete the table.

$x$	0	10	20	30	40	50	60	70	80	90
$P$		30			180			150	100	

b On graph paper draw axes for  $x$  and  $P(x)$ , placing  $x$  on the horizontal axis and  $P(x)$  on the vertical axis. Draw the graph of  $P(x)$  against  $x$  by plotting the points.

c Use your graph to find

- the maximum possible profit
- the number of glasses that need to be sold to make the maximum profit
- the number of glasses that need to be sold to make a profit of 160 euros
- the amount of money initially invested.

8 a Sketch the graph of the function  $f(x) = x^2 - 7$ ,  $x \in \mathbb{R}$ ,  $-4 \leq x \leq 4$ . Write down the coordinates of the points where the graph of  $y = f(x)$  intersects the axes.

b On the same diagram sketch the graph of the function

$$g(x) = 7 - x^2, \quad x \in \mathbb{R}, \quad -4 \leq x \leq 4.$$

c Solve the equation  $f(x) = g(x)$  in the given domain.