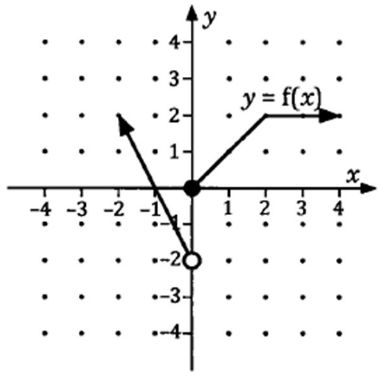
The graph of $y = f(x)$ is shown on the right.

Note: The "filled" and "empty" circles indicate where the function is (filled circle) and is not (empty circle). Thus $f(0) = 0$, not -2.



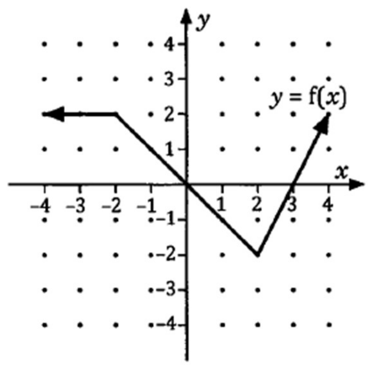
Draw the graph of each of the following.

(a) $y = f(x) + 1$ (b) $y = f(x + 2)$

(c) $y = 2f(x)$ (d) $y = f(0{\cdot}5x)$

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

4. The graph of $y = f(x)$ is shown on the right.
Draw the graph of each of the following.

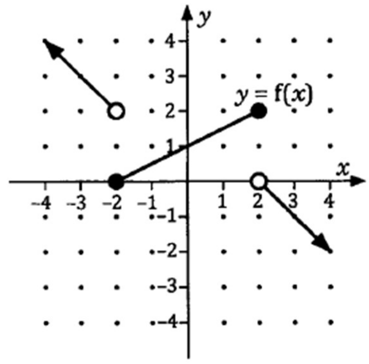


(a) $y = f(x - 2)$ (b) $y = f(x) + 2$

(c) $y = 2f(x)$ (d) $y = f(2x)$

(e) $y = -f(x)$ (f) $y = f(-x)$

5. The graph of $y = f(x)$ is shown on the right.
Find



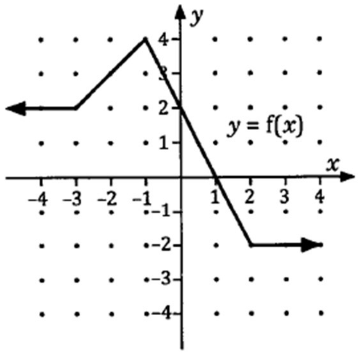
(a) $f(0)$ i.e. the value of y when $x = 0$.
(b) $f(1)$ i.e. the value of y when $x = 1$.
(c) $f(2)$
(d) $f(-3)$

Draw the graph of each of the following.

(e) $y = f(x + 1)$
(f) $y = f(-x)$
(g) $y = f(2x)$
(h) $y = f(0{\cdot}5x)$
(i) $y = 0{\cdot}5\, f(x)$

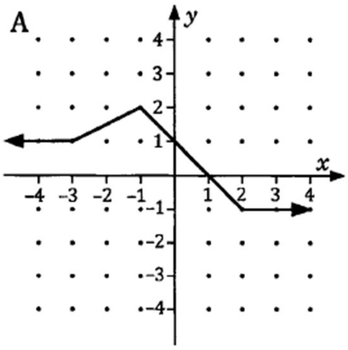
(j) Use your part (b) answer and your part (e) graph to confirm that $f(1) = f(0 + 1)$.
(k) Use your part (c) answer and your part (g) graph to confirm that $f(2) = f(2 \times 1)$.

6. The graph of $y = f(x)$ is as shown on the right. Choose the function from the "functions box" corresponding to each of the graphs A to F shown on the next page.

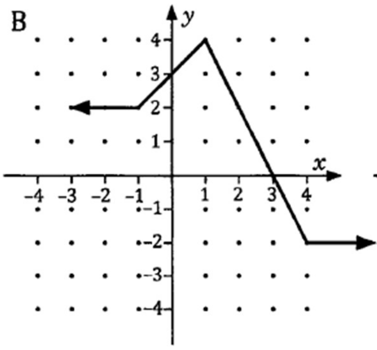


Functions Box			
I	$y = -f(x)$	II	$y = f(-x)$
III	$y = 0{\cdot}5\, f(x)$	IV	$y = f(0{\cdot}5x)$
V	$y = 2\, f(x)$	VI	$y = f(2x)$
VII	$y = f(x) + 2$	VIII	$y = f(x + 2)$
IX	$y = f(x) - 2$	X	$y = f(x - 2)$

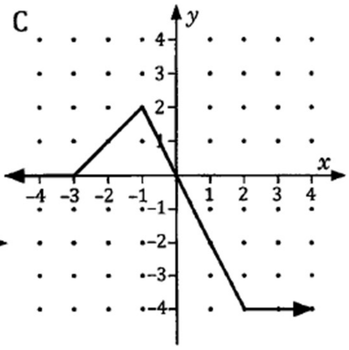
A



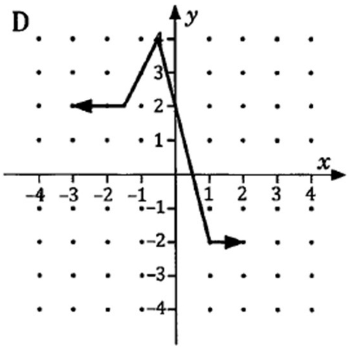
B



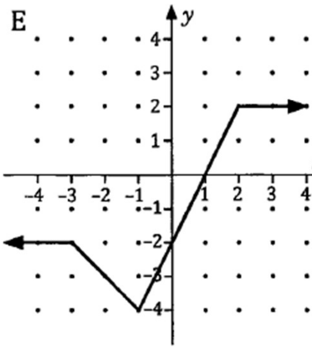
C



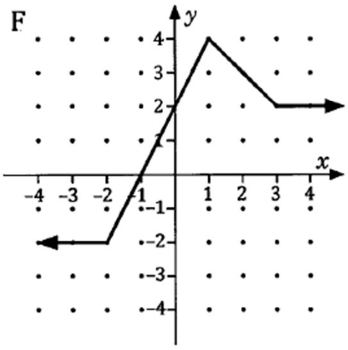
D



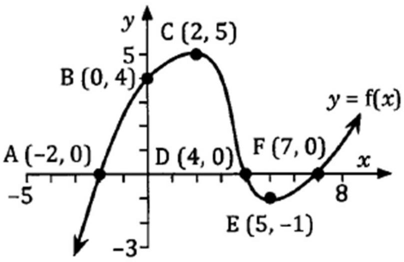
E



F



7. The graph of $y = f(x)$ shown on the right, cuts the x-axis at A(−2, 0), D(4, 0) and F(7, 0), cuts the y-axis at B(0, 4), has a maximum turning point at C(2, 5) and a minimum turning point at E(5, −1).



Find the coordinates of the points where

(a) $y = f(x - 3)$ cuts the x-axis,

(b) $y = f(2x)$ cuts the x-axis,

(c) $y = -f(x)$ cuts the x-axis

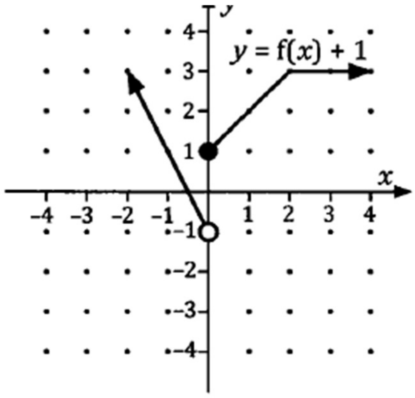
(d) $y = f(-x)$ cuts the x-axis,

(e) $y = f(x) + 3$ has its maximum turning point,

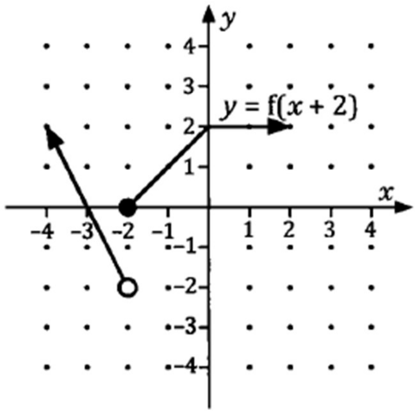
(f) $y = -f(x)$ has its maximum turning point.

Answers

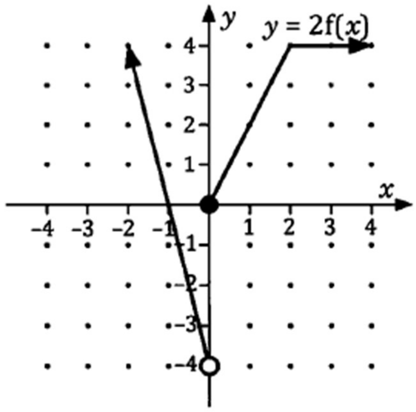
(a) To go from $y = f(x)$
to $y = f(x) + 1$
involves adding 1 to the right hand side.
Thus the graph of $y = f(x) + 1$
will be that of $y = f(x)$
translated vertically upwards 1 unit.



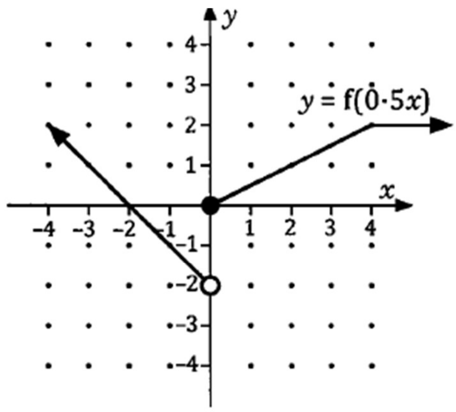
(b) To go from $y = f(x)$
to $y = f(x + 2)$
involves replacing x by $x + 2$.
Thus the graph of $y = f(x + 2)$
will be that of $y = f(x)$
translated 2 units to the left.



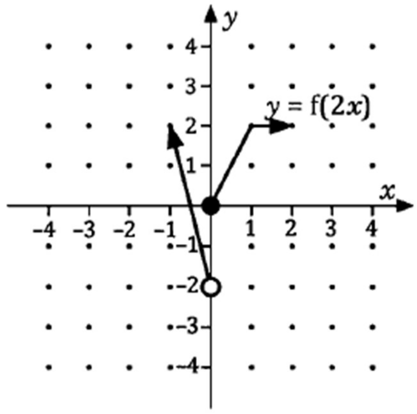
(c) To go from $y = f(x)$
to $y = 2f(x)$
involves multiplying the right hand side by 2.
Thus the graph of $y = 2f(x)$
will be that of $y = f(x)$
dilated parallel to the y-axis, scale factor 2.



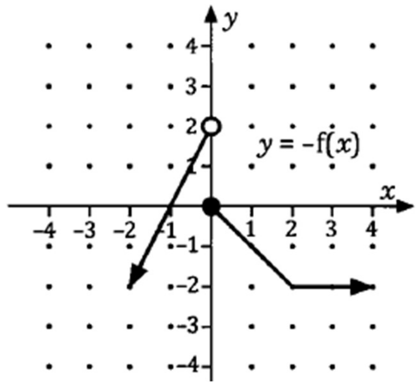
(d) To go from $y = f(x)$
to $y = f(0{\cdot}5x)$
involves replacing x by $0{\cdot}5x$.
Thus the graph of $y = f(0{\cdot}5x)$
will be that of $y = f(x)$
dilated parallel to the x-axis, scale factor $\frac{1}{0{\cdot}5}$
$= 2$.



(e) To go from $y = f(x)$
to $y = f(2x)$
involves replacing x by $2x$.
Thus the graph of $y = f(2x)$
will be that of $y = f(x)$
dilated parallel to the x-axis, scale factor $\frac{1}{2}$
$= 0{\cdot}5$.

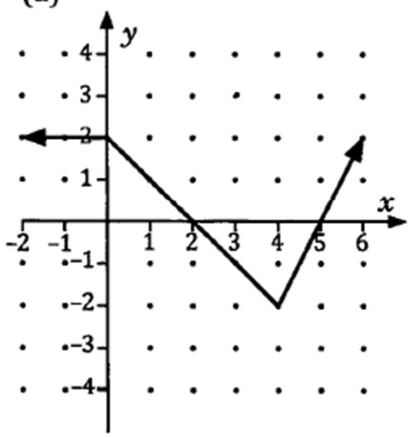


(f) To go from $y = f(x)$
to $y = -f(x)$
involves multiplying the right hand side by -1.
Thus the graph of $y = -f(x)$
will be that of $y = f(x)$
reflected in the x-axis.

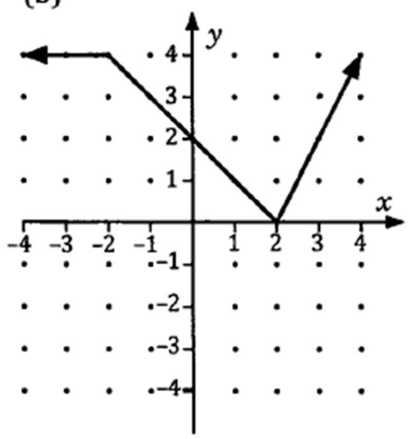


4.

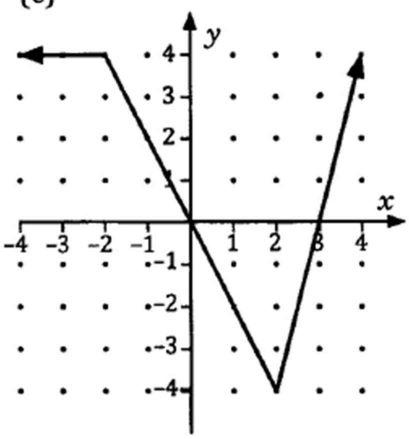
(a)



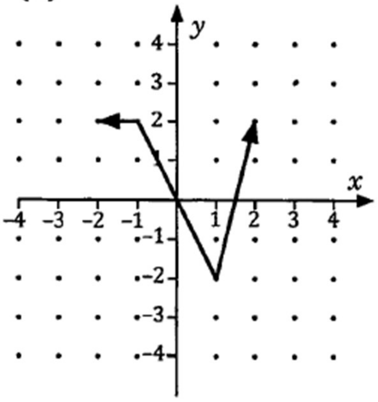
(b)



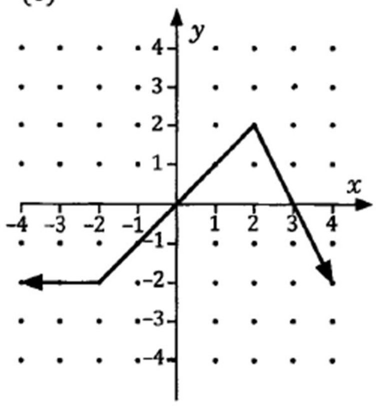
(c)



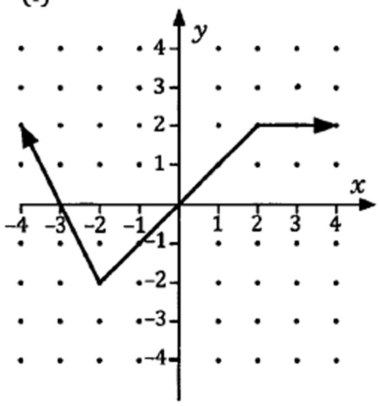
(d)



(e)

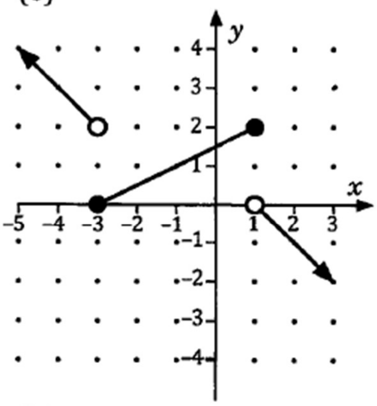


(f)

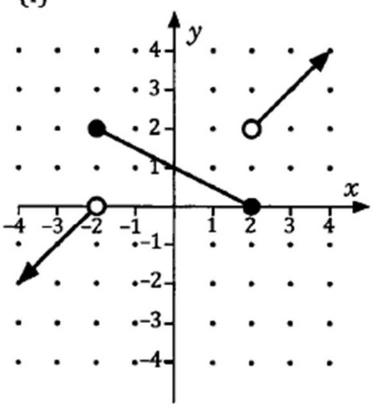


5. (a) 1 (b) 1·5 (c) 2 (d) 3

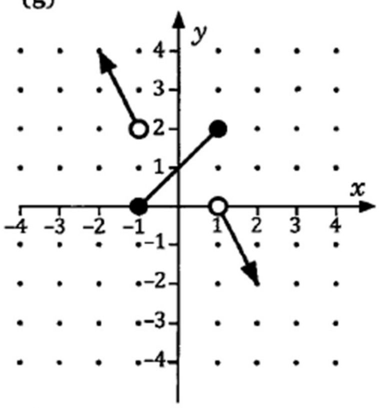
(e)



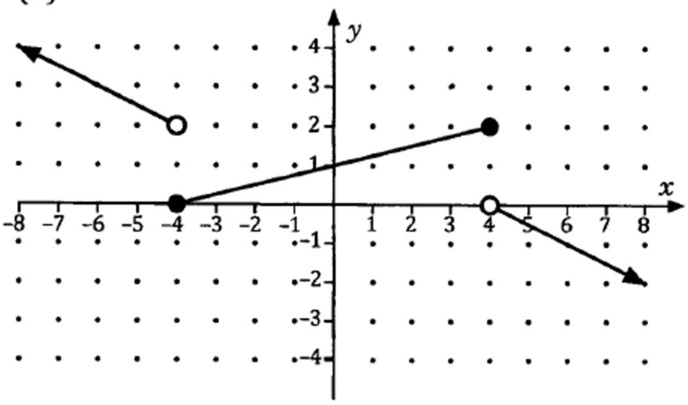
(f)



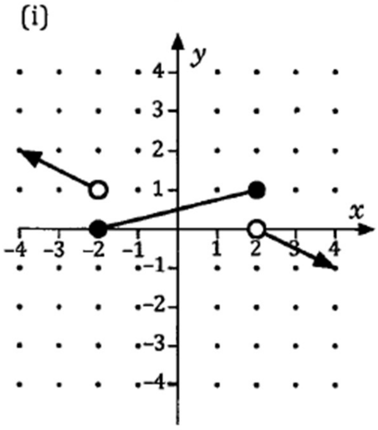
(g)



(h)



(i)



6. A: III, B: X, C: IX, D: VI, E: I, F: II

7. (a) (1, 0), (7, 0), (10, 0) (b) (−1, 0), (2, 0), (3·5, 0)

(c) (−2, 0), (4, 0), (7, 0) (d) (−7, 0), (−4, 0), (2, 0)

(e) (2, 8) (f) (5, 1)