AQA Level 2 Further mathematics Number & algebra

Section 3: Functions and their graphs

Section test

Questions 1 and 2 refer to the function defined by $f(x) = 1 - x^2$, where $-1 \le x \le 1$.

1) The value of f(0.5) is

(a) 0.5
(b) 0.25
(c) 0.75
(d) 0
(e) I don't know

2) The range of the function is given by:

(a) $0 \le f(x) \le 2$
(b) $-1 \le f(x) \le 1$
(c) $-1 \le f(x) \le 0$
(d) $0 \le f(x) \le 1$
(e) I don't know

Questions 3 and 4 refer to the function defined by $f(x) = x^2 - x - 6$

3) The value of f(−4) is:

(a) 10
(b) 6
(c) −4
(d) 14
(e) I don't know

4) An expression for f(2x) is

(a) $4x^2 - 2x - 6$
(b) $2x^2 - 2x - 6$
(c) $2x^2 - 2x - 12$
(d) $x^2 - x - 4$
(e) I don't know

Questions 5 and 6 refer to the function defined by $f(x) = \dfrac{1}{x^2 + x - 2}$

5) The domain of the function is all x other than $x = a$ and $x = b$.
The values of a and b are

(a) 2 and -1
(b) -2 and 1
(c) 0 and -2
(d) 0 and 2
(e) I don't know

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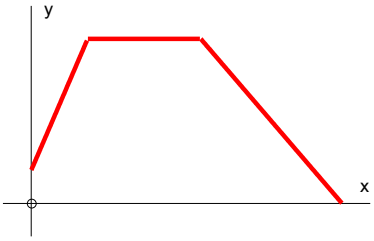
6) The value of f(3) =

(a) $\frac{1}{7}$
(b) 10
(c) $\frac{1}{10}$
(d) 7
(e) I don't know

7) A function f is defined by

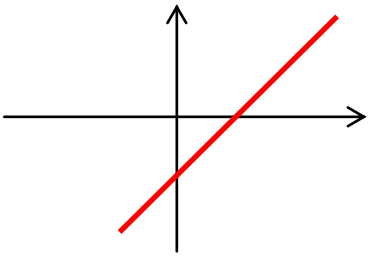
$$\begin{aligned} f(x) &= 2x+1 \quad && 0 \le x < 2 \\ &= a && 2 \le x < 6 \\ &= b - x && 6 \le x \le c \end{aligned}$$

The graph of $y = f(x)$ is shown in the diagram.
What are the values of a, b and c?



(a) $a = 5$, $b = 11$, $c = 11$
(b) $a = 1$, $b = 1$, $c = 1$
(c) $a = 5$, $b = 5$, $c = 5$
(d) $a = 3$, $b = 6$, $c = 6$
(e) I don't know

8) The diagram shows a sketch of one of the following lines. Which one?



(a) $y - x + 1 = 0$
(b) $y + x = 1$
(c) $y = x + 1$
(d) $y + x + 1 = 0$
(e) I don't know

9) P is the point (2, 7). Q is the point (6, -3).
What is the gradient of PQ?

(a) 0.4
(b) -0.4
(c) 2.5
(d) -2.5
(e) I don't know

10) A straight line has a gradient of –2 and passes through the point (4, 1). What is its equation?

(a) $y + 2x = 6$
(b) $y = 2x - 6$
(c) $2y = x - 2$
(d) $y + 2x - 9 = 0$
(e) I don't know

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Solutions to section test

1) The correct answer is (c)

$$f(x) = 1 - x^2$$
$$f(0.5) = 1 - 0.5^2$$
$$= 1 - 0.25$$
$$= 0.75$$

2) The correct answer is (d)

The smallest possible value of f(x) where $-1 \le x \le 1$ is 0, when $x = \pm 1$.
The greatest possible value of f(x) where $-1 \le x \le 1$ is 1, when $x = 0$.
So the range of the function is given by $0 \le f(x) \le 1$.

3) The correct answer is (d)

$$f(x) = x^2 - x - 6$$
$$f(-4) = (-4)^2 - (-4) - 6$$
$$= 16 + 4 - 6$$
$$= 14$$

4) The correct answer is (a)

$$f(2x) = (2x)^2 - (2x) - 6$$
$$= 4x^2 - 2x - 6$$

5) The correct answer is (b)

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

The denominator is zero at x = -2 and x = 1, so the function is not defined at these points. So the domain is all values of x except x = -2 and x = 1.

6) The correct answer is (c)

$$f(3) = \frac{1}{3^2 + 3 - 2} = \frac{1}{9 + 3 - 2} = \frac{1}{10}$$

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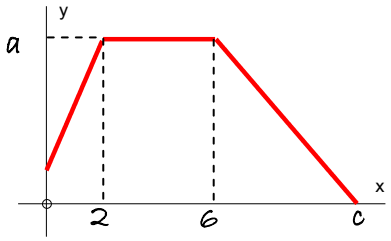
7) The correct answer is (a)

$f(x) = 2x + 1 \quad 0 \le x < 2$

$= a \quad 2 \le x < 6$

$= b - x \quad 6 \le x \le c$



When $x = 2$, $f(x) = 2 \times 2 + 1 = 5$

so $a = 5$

When $x = 6$, $f(x) = 5$, so $b - x = 5$

$b - 6 = 5 \quad \Rightarrow b = 11$

When $x = c$, $f(c) = 0$

$b - c = 0$

$11 - c = 0 \quad \Rightarrow c = 11$

So $a = 5$, $b = 11$, $c = 11$

8) The correct answer is (a)

(a) can be written as $y = x - 1$ (b) can be written as $y = -x + 1$

(c) can be written as $y = x + 1$ (d) can be written as $y = -x - 1$

The line in the diagram has a positive gradient and a negative intercept, so (a) is the correct equation.

9) The correct answer is (d)

$$\text{Gradient of PQ} = \frac{y_1 - y_2}{x_1 - x_2} = \frac{7 - (-3)}{2 - 6} = \frac{10}{-4} = -2.5$$

10) The correct answer is (d)

$y - y_1 = m(x - x_1)$

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

$y - 1 = -2x + 8$

$y + 2x - 9 = 0$