CHAPTER 3.1

Quadratic Functions

Multiple-Choice Old Exam Questions

24 questions • 4 topics • options A–E • two questions per page

Topic 1 | Range, Vertex and Axis of Symmetry

Finding the range, the vertex, the axis of symmetry and the increasing or decreasing intervals of a parabola • Questions 1–8

Q **1**

The range of the function $f(x) = -\frac{1}{3}x^2 + 2x + 7$ is

A) $(-\infty, 10]$

B) $(-\infty, 3]$

C) $(-\infty, 7]$

D) $[10, \infty)$

E) $[3, \infty)$

Q **2**

The range of the function $f(x) = -\frac{1}{2}x^2 + 6x + 17$ is

A) $[35, \infty)$

B) $(-\infty, 17]$

C) $(-\infty, 35]$

D) $[17, \infty)$

E) $[-35, 0]$

Q
3

If $(1,\ k)$ is the vertex of the quadratic function $f(x) = -2x^2 + mx + m + 1$, then the range of f is

A) $(-\infty,\ 4]$

B) $(-\infty,\ 1]$

C) $[4,\ \infty)$

D) $[7,\ \infty)$

E) $(-\infty,\ 7]$

Q
4

Given the function $f(x) = x^2 + 4x + 2$ with domain $[-3,\ -2]$, the maximum value of the graph of $f(x)$ is

A) -1

B) 2

C) 0

D) -2

E) no maximum value

Q
5

If $-3 \leq x \leq 0$, then the range of the function $f(x) = (x+1)^2 + 1$ is equal to

A) $[1, 5]$

B) $[2, 5]$

C) $[1, \infty)$

D) $[2, \infty)$

E) $[5, \infty)$

Q
6

The graph of the function $f(x) = -x^2 + 14x - 47$ is

A) increasing over $(-\infty, 7]$ and has range $(-\infty, 2]$

B) increasing over $(-\infty, 2]$ and has range $(-\infty, 7]$

C) decreasing over $(-\infty, 7]$ and has range $(-\infty, 7]$

D) decreasing over $[7, \infty)$ and has range $(-\infty, \infty)$

E) decreasing over $(-\infty, \infty)$ and has range $(-\infty, 2]$

Q
7

Which one of the following statements is TRUE about the graph of the function $f(x) = -2x^2 + 2x + \frac{3}{2}$?

A) The graph is decreasing on $\left[\frac{1}{2}, \infty\right)$

B) The graph has no x-intercept

C) The vertex is the point $\left(\frac{1}{2}, \frac{3}{2}\right)$

D) The range is $\left(-\infty, \frac{3}{2}\right]$

E) The axis of symmetry is the line $y = \frac{1}{2}$

Q
8

The quadratic function $f(x) = -5x^2 - 6x + 2$ has its axis of symmetry as

A) $x = -\frac{19}{5}$

B) $y = \frac{19}{5}$

C) $y = -\frac{3}{2}$

D) $x = \frac{3}{4}$

E) $x = -\frac{3}{5}$

Topic 2 | Finding Parameters of a Quadratic Function

Using the vertex, the axis of symmetry and the intercepts to find unknown constants • Questions 9–14

Q **9**

If $(2, -1)$ is the lowest point on the graph of the quadratic function $f(x) = ax^2 - 8x + c$, then $a + c =$

A) 9

B) 0

C) 1

D) 11

E) -2

Q **10**

If the line $2x + 3y = 2$ passes through the vertex of the parabola $y = -2x^2 + 4x + c$, then c is equal to

A) -2

B) -1

C) -3

D) $-\frac{1}{2}$

E) $-\frac{1}{3}$

Q
11

If the vertex of the parabola $y = -x^2 + 8x + 2c$ is a point on the x-axis, then the value of c is equal to

A) -8

B) -32

C) 32

D) 64

E) -64

Q
12

If $x = 3$ is the axis of symmetry of the parabola $f(x) = -x^2 + 2cx + c^2 + 4$ for some constant c, then the maximum value of $f(x)$ is equal to

A) 18

B) 3

C) 6

D) 13

E) 22

Q
13

If the slope of the line through $(2, -3)$ and the vertex of the parabola $y = (x + m)^2 - 5$ is $\frac{3}{m}$, then m is

A) -2

B) -5

C) -4

D) -3

E) -6

Q
14

If the quadratic function $f(x) = ax^2 + bx + c$ has only one x-intercept $(2, 0)$ and y-intercept $(0, -8)$, then $a + b + c =$

A) -2

B) 2

C) 0

D) -8

E) 6

Topic 3 | Intercepts and Quadratic Inequalities

Using the discriminant, the zeros and the sign of a quadratic function • Questions 15–18

Q **15**

If the graph of the quadratic function $f(x) = -2x^2 + 3x + c$ intersects the x-axis at two different points, then c is any number in the interval

A) $\left(-\frac{9}{8}, \infty\right)$

B) $(-3, \infty)$

C) $\left(-3, -\frac{9}{8}\right)$

D) $\left(-\frac{3}{2}, \infty\right)$

E) $\left(-\frac{3}{2}, -\frac{9}{8}\right)$

Q **16**

The graph of $f(x) = -\frac{1}{2}x^2 + 6x - 16$ is completely above the x-axis on the interval

A) $[6, 8]$

B) $(4, 8)$

C) $(4, 6) \cup (6, 8)$

D) $(-\infty, 4) \cup (8, \infty)$

E) $(-\infty, 6) \cup (8, \infty)$

Q
17

One of the x-intercepts of the graph of the function $f(x) = 3x^2 + kx - 4$ is 4. Then the other x-intercept is equal to

A) 11

B) -11

C) -4

D) $-\frac{1}{3}$

E) $\frac{1}{3}$

Q
18

A ball is thrown directly upward, and its height is given by $h(t) = -16t^2 + 80t + 32$, where t is the time in seconds. The time interval, in seconds, during which the ball is more than 96 feet above the ground is

A) $(1, 4)$

B) $(2, 8)$

C) $(2, 5)$

D) $(3, 6)$

E) $(4, 8)$

Topic 4 | Maximum and Minimum Applications

Optimization with quadratic functions: products, areas and projectile motion • Questions 19–24

Q **19**

If p and q are two integers such that $3p - q = 18$ and the product pq is minimum, then $p + q =$

A) 6

B) -3

C) -6

D) 3

E) 1

Q **20**

The maximum value of the product $(3 - 2x)(x + 2)$ is

A) $\frac{45}{4}$

B) $\frac{49}{8}$

C) $\frac{49}{4}$

D) 6

E) 4

Q
21

If the sum of two numbers is 106 and their product is maximum, then the difference of these numbers is

A) 10

B) 2

C) 0

D) 14

E) 53

Q
22

The maximum area of a rectangle that has perimeter 1600 meters is equal to

A) 160,000 square meters

B) 240,000 square meters

C) 20,000 square meters

D) 40,000 square meters

E) 80,000 square meters

Q
23

A ball is thrown up in the air, and its height h, in meters, is given by $h(t) = -16t^2 + 128t + 105$, where t is the time in seconds. The time it takes the ball to reach its maximum height is

A) 4 seconds

B) 1 second

C) 2 seconds

D) 8 seconds

E) 16 seconds

Q
24

A ball is thrown vertically upward. If its height h, in feet, is given by $h(t) = -16t^2 + 80t + 100$, where t is the time in seconds, then the maximum height the ball attains is

A) 200 feet

B) 150 feet

C) 300 feet

D) 100 feet

E) 250 feet

Answer Key

"Original" shows the question number in the source worksheet.

Q	Original	Ans.	Value
1	1	**A**	$(-\infty, 10]$
2	10	**C**	$(-\infty, 35]$
3	24	**E**	$(-\infty, 7]$
4	2	**A**	-1
5	3	**A**	$[1, 5]$
6	9	**A**	increasing over $(-\infty, 7]$ and has range $(-\infty, 2]$
7	8	**A**	The graph is decreasing on $\left[\frac{1}{2}, \infty\right)$
8	22	**E**	$x = -\frac{3}{5}$
9	4	**A**	9
10	5	**A**	-2
11	11	**A**	-8
12	20	**E**	22
13	21	**E**	-6
14	23	**A**	-2
15	6	**A**	$\left(-\frac{9}{8}, \infty\right)$
16	15	**B**	$(4, 8)$
17	16	**D**	$-\frac{1}{3}$
18	7	**A**	$(1, 4)$
19	12	**C**	-6
20	13	**B**	$\frac{49}{8}$
21	19	**C**	0
22	14	**A**	160,000 square meters
23	17	**A**	4 seconds
24	18	**A**	200 feet