

PreCalc 11 Chapter 4 Review Pack v1

Answer Section

MULTIPLE CHOICE

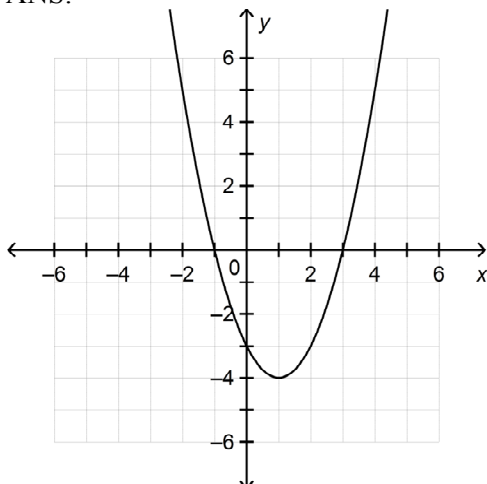
1. ANS: D PTS: 0 DIF: Easy
REF: 4.1 Properties of a Quadratic Function LOC: 11.RF4
TOP: Relations and Functions KEY: Conceptual Understanding
2. ANS: A PTS: 0 DIF: Easy
REF: 4.1 Properties of a Quadratic Function LOC: 11.RF4
TOP: Relations and Functions KEY: Conceptual Understanding
3. ANS: A PTS: 0 DIF: Moderate
REF: 4.1 Properties of a Quadratic Function LOC: 11.RF4
TOP: Relations and Functions KEY: Procedural Knowledge
4. ANS: A PTS: 0 DIF: Moderate
REF: 4.1 Properties of a Quadratic Function LOC: 11.RF4
TOP: Relations and Functions KEY: Problem-Solving Skills | Procedural Knowledge
5. ANS: A PTS: 0 DIF: Easy
REF: 4.2 Solving a Quadratic Equation Graphically LOC: 11.RF5
TOP: Relations and Functions KEY: Conceptual Understanding
6. ANS: B PTS: 0 DIF: Easy
REF: 4.2 Solving a Quadratic Equation Graphically LOC: 11.RF5
TOP: Relations and Functions KEY: Procedural Knowledge
7. ANS: A PTS: 0 DIF: Easy
REF: 4.3 Transforming the Graph of $y = x^2$ LOC: 11.RF3
TOP: Relations and Functions KEY: Conceptual Understanding
8. ANS: C PTS: 0 DIF: Easy
REF: 4.3 Transforming the Graph of $y = x^2$ LOC: 11.RF3
TOP: Relations and Functions KEY: Conceptual Understanding
9. ANS: D PTS: 0 DIF: Easy
REF: 4.3 Transforming the Graph of $y = x^2$ LOC: 11.RF3
TOP: Relations and Functions KEY: Conceptual Understanding
10. ANS: B PTS: 0 DIF: Easy
REF: 4.3 Transforming the Graph of $y = x^2$ LOC: 11.RF3
TOP: Relations and Functions KEY: Conceptual Understanding
11. ANS: B PTS: 0 DIF: Easy
REF: 4.4 Analyzing Quadratic Functions of the Form $y = a(x - p)^2 + q$
LOC: 11.RF3 TOP: Relations and Functions KEY: Conceptual Understanding
12. ANS: B PTS: 0 DIF: Moderate
REF: 4.4 Analyzing Quadratic Functions of the Form $y = a(x - p)^2 + q$
LOC: 11.RF3 TOP: Relations and Functions KEY: Procedural Knowledge
13. ANS: A PTS: 0 DIF: Moderate
REF: 4.5 Equivalent Forms of the Equation of a Quadratic Function
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge
14. ANS: B PTS: 0 DIF: Easy
REF: 4.5 Equivalent Forms of the Equation of a Quadratic Function
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge

15. ANS: A PTS: 0 DIF: Easy
REF: 4.5 Equivalent Forms of the Equation of a Quadratic Function
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge
16. ANS: A PTS: 0 DIF: Easy
REF: 4.6 Analyzing Quadratic Functions of the Form $y = ax^2 + bx + c$
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge
17. ANS: A PTS: 0 DIF: Easy
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18. ANS: C PTS: 0 DIF: Moderate
REF: 4.6 Analyzing Quadratic Functions of the Form $y = ax^2 + bx + c$
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19. ANS: D PTS: 0 DIF: Moderate
REF: 4.6 Analyzing Quadratic Functions of the Form $y = ax^2 + bx + c$
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge
20. ANS: B PTS: 0 DIF: Easy
REF: 4.7 Modelling and Solving Problems with Quadratic Functions
LOC: 11.RF4 TOP: Relations and Functions KEY: Conceptual Understanding
21. ANS: A PTS: 0 DIF: Moderate
REF: 4.7 Modelling and Solving Problems with Quadratic Functions
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge
22. ANS: D PTS: 0 DIF: Moderate
REF: 4.7 Modelling and Solving Problems with Quadratic Functions
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge
23. ANS: D PTS: 0 DIF: Moderate
REF: 4.7 Modelling and Solving Problems with Quadratic Functions
LOC: 11.RF4 TOP: Relations and Functions KEY: Procedural Knowledge

SHORT ANSWER

24. ANS:
A quadratic function
- PTS: 0 DIF: Moderate REF: 4.1 Properties of a Quadratic Function
LOC: 11.RF4 TOP: Relations and Functions
KEY: Communication | Conceptual Understanding | Procedural Knowledge

25. ANS:

Vertex: $(1, -4)$ Axis of symmetry: $x = 1$

PTS: 0 DIF: Moderate REF: 4.1 Properties of a Quadratic Function

LOC: 11.RF4 TOP: Relations and Functions

KEY: Conceptual Understanding | Procedural Knowledge

26. ANS:

a) The ball reached its maximum height after 0.8 s.

b) The ball's maximum height was 5.2 m.

PTS: 0 DIF: Moderate REF: 4.1 Properties of a Quadratic Function

LOC: 11.RF4 TOP: Relations and Functions

KEY: Problem-Solving Skills | Procedural Knowledge

27. ANS:

 $x = -4$ and $x = 4$

PTS: 0 DIF: Easy REF: 4.2 Solving a Quadratic Equation Graphically

LOC: 11.RF5 TOP: Relations and Functions KEY: Conceptual Understanding

28. ANS:

The graph does not intersect the x -axis, so the equation $5x^2 + 9x + 10 = 0$ has no real roots.

PTS: 0 DIF: Easy REF: 4.2 Solving a Quadratic Equation Graphically

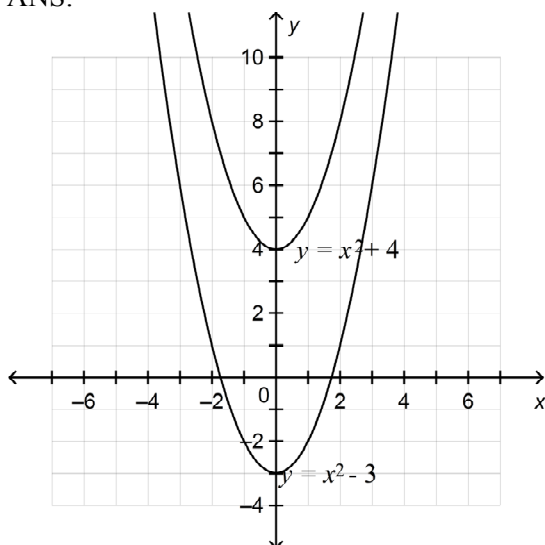
LOC: 11.RF5 TOP: Relations and Functions KEY: Procedural Knowledge

29. ANS:

Function	Direction of opening	Vertex	Axis of Symmetry	Congruent to $y = x^2$?
$y = x^2 + 6$	up	(0, 6)	$x = 0$	yes
$y = 6x^2$	up	(0, 0)	$x = 0$	no
$y = (x + 2)^2$	up	(-2, 0)	$x = -2$	yes
$y = x^2$	up	(0, 0)	$x = 0$	yes
$y = -6x^2$	down	(0, 0)	$x = 0$	no
$y = (x - 6)^2$	up	(6, 0)	$x = 6$	yes
$y = x^2 - 2$	up	(0, -2)	$x = 0$	yes

PTS: 0 DIF: Moderate REF: 4.3 Transforming the Graph of $y = x^2$
 LOC: 11.RF3 TOP: Relations and Functions
 KEY: Communication | Conceptual Understanding

30. ANS:



PTS: 0 DIF: Moderate REF: 4.3 Transforming the Graph of $y = x^2$
 LOC: 11.RF3 TOP: Relations and Functions
 KEY: Conceptual Understanding | Procedural Knowledge

31. ANS:

- The graph has 2 x -intercepts.
- The graph has 1 x -intercept.
- The graph has 0 x -intercepts.

PTS: 0 DIF: Moderate
 REF: 4.4 Analyzing Quadratic Functions of the Form $y = a(x - p)^2 + q$
 LOC: 11.RF3 TOP: Relations and Functions
 KEY: Conceptual Understanding | Procedural Knowledge

32. ANS:

$$y = -2(x - 3)^2 + 7$$

PTS: 0

DIF: Difficult

REF: 4.4 Analyzing Quadratic Functions of the Form $y = a(x - p)^2 + q$

LOC: 11.RF3 TOP: Relations and Functions

KEY: Conceptual Understanding | Procedural Knowledge

33. ANS:

The number that would be added is $\frac{121}{16}$.

$$x^2 + \frac{11}{2}x + \frac{121}{16} = \left(x + \frac{11}{4}\right)^2$$

PTS: 0

DIF: Easy

REF: 4.5 Equivalent Forms of the Equation of a Quadratic Function

LOC: 11.RF4 TOP: Relations and Functions

KEY: Procedural Knowledge

34. ANS:

$$y = 2\left(x + \frac{21}{4}\right)^2 - \frac{9}{8}; \left(-\frac{21}{4}, -\frac{9}{8}\right)$$

PTS: 0

DIF: Moderate

REF: 4.5 Equivalent Forms of the Equation of a Quadratic Function

LOC: 11.RF4 TOP: Relations and Functions

KEY: Conceptual Understanding | Procedural Knowledge

35. ANS:

$$y = -3(x - 1)(x - 5)$$

PTS: 0

DIF: Moderate

REF: 4.6 Analyzing Quadratic Functions of the Form $y = ax^2 + bx + c$

LOC: 11.RF4 TOP: Relations and Functions

KEY: Procedural Knowledge

36. ANS:

$$y = 3x^2 - 33x + 90$$

PTS: 0

DIF: Moderate

REF: 4.6 Analyzing Quadratic Functions of the Form $y = ax^2 + bx + c$

LOC: 11.RF4 TOP: Relations and Functions

KEY: Procedural Knowledge

37. ANS:

maximum value; -2

PTS: 0

DIF: Easy

REF: 4.7 Modelling and Solving Problems with Quadratic Functions

LOC: 11.RF4 TOP: Relations and Functions

KEY: Conceptual Understanding

38. ANS:
a) 2000
b) \$1600

PTS: 0 DIF: Moderate
REF: 4.7 Modelling and Solving Problems with Quadratic Functions
LOC: 11.RF4 TOP: Relations and Functions
KEY: Problem-Solving Skills | Procedural Knowledge

39. ANS:
11 250 m²

PTS: 0 DIF: Moderate
REF: 4.7 Modelling and Solving Problems with Quadratic Functions
LOC: 11.RF4 TOP: Relations and Functions
KEY: Problem-Solving Skills | Procedural Knowledge

PROBLEM

40. ANS:
a) The x -coordinates increase by 2 each time.

First differences:

$$-2 - (-6) = 4$$

$$2 - (-2) = 4$$

$$6 - (2) = 4$$

$$10 - (6) = 4$$

The first differences are constant, so the function is linear.

- b) The x -coordinates increase by 2 each time.

First differences:

$$10 - (42) = -32$$

$$2 - (10) = -8$$

$$18 - (2) = 16$$

$$58 - (18) = 40$$

The first differences increase by 24 each time, so the function is quadratic.

PTS: 0 DIF: Moderate REF: 4.1 Properties of a Quadratic Function
LOC: 11.RF4 TOP: Relations and Functions
KEY: Communication | Procedural Knowledge

41. ANS:

- b) The t -intercepts are -0.11 and 5.82 . The t -intercepts represent the times at which the height of the rocket is 0 m. Time cannot be negative, so the height of the rocket is 0 m at about 5.82 s.
c) The maximum value of the function represents the greatest height of the rocket. The greatest height that the rocket reached was approximately 43 m.
d) The domain is: $0 \leq t \leq 5.82$. The domain represents the time the toy rocket was in the air: about 5.82 s.

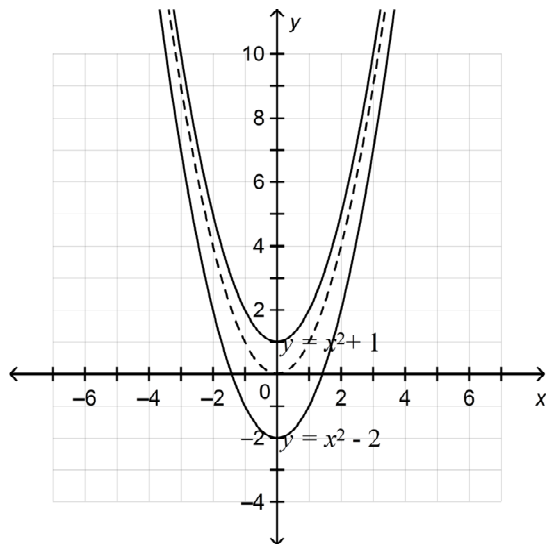
PTS: 0 DIF: Difficult REF: 4.1 Properties of a Quadratic Function
LOC: 11.RF4 TOP: Relations and Functions
KEY: Conceptual Understanding | Problem-Solving Skills | Procedural Knowledge

42. ANS:

I first sketched the graph of $y = x^2$ as a broken curve.

a) I translated the graph of $y = x^2$ 1 unit up to get the graph of $y = x^2 + 1$.

b) I translated the graph of $y = x^2$ 2 units down to get the graph of $y = x^2 - 2$.



PTS: 0

DIF: Moderate

REF: 4.3 Transforming the Graph of $y = x^2$

LOC: 11.RF3

TOP: Relations and Functions

KEY: Communication | Conceptual Understanding | Procedural Knowledge

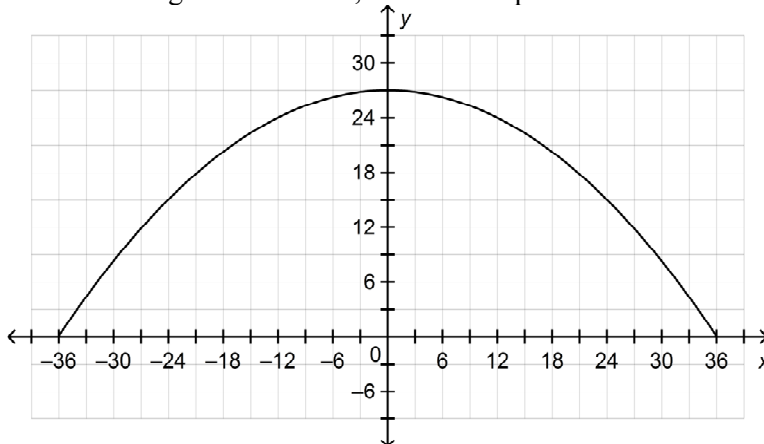
43. ANS:

Sketch the parabola on the coordinate plane so the line of symmetry is the y -axis.

The y -intercept represents the maximum height.

The vertex of the parabola is 27 m above the base, so the coordinates of the vertex are $V(0, 27)$.

Since the bridge is 72 m wide, the x -intercepts are -36 and 36 .



The equation of the parabola has the form $y = a(x - p)^2 + q$, with vertex (p, q) .

The coordinates of the vertex are $V(0, 27)$, so $p = 0$ and $q = 27$.

So, the equation of the parabola becomes $y = ax^2 + 27$.

To determine the value of a , substitute the coordinates of an x -intercept: $(36, 0)$

$$y = ax^2 + 27 \quad \text{Substitute: } x = 36, y = 0$$

$$0 = a(36)^2 + 27 \quad \text{Solve for } a.$$

$$-1296a = 27$$

$$a = -\frac{1}{48}$$

An equation of the parabola is: $y = -\frac{1}{48}x^2 + 27$

PTS: 0 DIF: Difficult

REF: 4.4 Analyzing Quadratic Functions of the Form $y = a(x - p)^2 + q$

LOC: 11.RF3 TOP: Relations and Functions

KEY: Communication | Problem-Solving Skills

44. ANS:

$$\begin{aligned}
y &= a(x-x_1)(x-x_2) \\
&= a(x^2 - x_1x - x_2x + x_1x_2) \\
&= a[x^2 - x(x_1+x_2)] + ax_1x_2 \\
&= a\left(x^2 - x(x_1+x_2) + \frac{(x_1+x_2)^2}{4} - \frac{(x_1+x_2)^2}{4}\right) + ax_1x_2 \\
&= a\left(x - \frac{(x_1+x_2)}{2}\right)^2 - a\left(\frac{(x_1+x_2)^2}{4}\right) + ax_1x_2 \\
&= a\left(x - \frac{(x_1+x_2)}{2}\right)^2 - a\left(\frac{x_1^2 + 2x_1x_2 + x_2^2}{4}\right) + \frac{4ax_1x_2}{4} \\
&= a\left(x - \frac{(x_1+x_2)}{2}\right)^2 + \frac{-ax_1^2 - 2ax_1x_2 - ax_2^2 + 4ax_1x_2}{4} \\
&= a\left(x - \frac{(x_1+x_2)}{2}\right)^2 + \frac{-ax_1^2 - 2ax_1x_2 + 4ax_1x_2 - ax_2^2}{4} \\
&= a\left(x - \frac{(x_1+x_2)}{2}\right)^2 + \frac{-ax_1^2 + 2ax_1x_2 - ax_2^2}{4} \\
&= a\left(x - \frac{(x_1+x_2)}{2}\right)^2 - \frac{a}{4}(x_1^2 - 2x_1x_2 + x_2^2) \\
&= a\left(x - \frac{(x_1+x_2)}{2}\right)^2 - \frac{a}{4}(x_1 - x_2)^2
\end{aligned}$$

Compare with the standard form of the equation $y = a(x-p)^2 + q$:

$$p = \frac{(x_1+x_2)}{2} \text{ and } q = -\frac{a}{4}(x_1 - x_2)^2$$

PTS: 0

DIF: Difficult

REF: 4.6 Analyzing Quadratic Functions of the Form $y = ax^2 + bx + c$

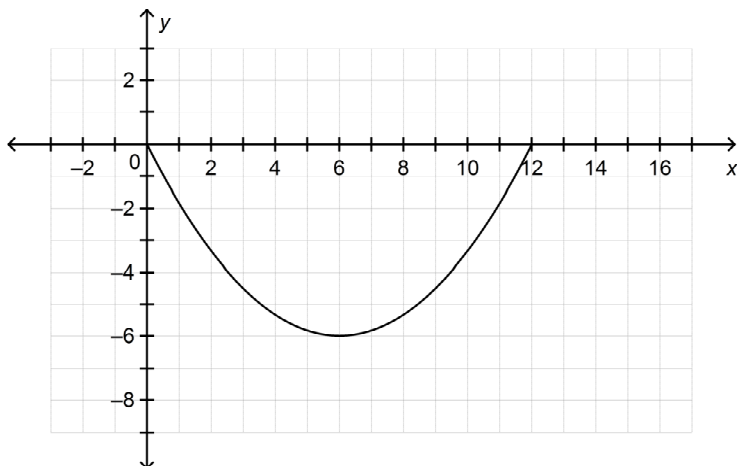
LOC: 11.RF4

TOP: Relations and Functions

KEY: Communication | Problem-Solving Skills

45. ANS:

- a) Sketch the parabola on coordinate axes, with one end of the trough at the origin.
Since the trough is 12 m wide, the other end of the trough has coordinates (12, 0).



At a point 3 m from the origin, the trough is 4.5 m deep. So the parabola passes through the point $(3, -4.5)$.

The x -intercepts are 0 and 12, so use the factored form of the equation of a quadratic function:

$$y = a(x - x_1)(x - x_2)$$

Substitute: $x_1 = 0$ and $x_2 = 12$

The equation becomes: $y = a(x - 0)(x - 12)$, or $y = ax(x - 12)$

The coordinates of the given point satisfy the equation, so use them to determine the value of a .

Substitute: $x = 3$ and $y = -4.5$ in $y = ax(x - 12)$

$$-4.5 = a(3)(3 - 12)$$

$$-4.5 = -27a$$

$$a = \frac{1}{6}$$

Substitute $a = \frac{1}{6}$ in $y = ax(x - 12)$.

An equation that represents the cross section of the trough is: $y = \frac{1}{6}x(x - 12)$

- b) The centre of the cross section is at the vertex of the parabola. The depth of the trough is the y -coordinate of the vertex.

The x -coordinate of the vertex is halfway between 0 and 12; that is, $x = 6$

Substitute $x = 6$ in $y = \frac{1}{6}x(x - 12)$

$$y = \frac{1}{6}(6)(6 - 12)$$

$$y = -6$$

The greatest depth of the trough is 6 m.

PTS: 0

DIF: Difficult

REF: 4.6 Analyzing Quadratic Functions of the Form $y = ax^2 + bx + c$

LOC: 11.RF4 TOP: Relations and Functions

KEY: Communication | Problem-Solving Skills

46. ANS:

Graph the equation. Use the CALC feature to determine the coordinates of the vertex.

The h -coordinate of the vertex is the maximum height of the rocket: approximately 22.4 m.

The amount of time the rocket was in the air is the positive t -intercept: approximately 4.2 s.

PTS: 0 DIF: Moderate

REF: 4.7 Modelling and Solving Problems with Quadratic Functions

LOC: 11.RF4 TOP: Relations and Functions

KEY: Problem-Solving Skills | Procedural Knowledge

47. ANS:

Let the width of each rectangle be w metres. Let the length of the rectangle made up of the 2 smaller rectangles be l metres.

The area, A square metres, is given by the equation $A = lw$.

The perimeter of the rectangular pens is 78 m.

So, $78 = 2l + 3w$

$$78 - 2l = 3w$$

$$w = \frac{1}{3}(78 - 2l)$$

$$\text{So, } A = \frac{1}{3}l(78 - 2l)$$

$$A = -\frac{2}{3}l(l - 39)$$

The coefficient of l^2 is negative, so the graph has a maximum value.

From the equation, the l -intercepts are: 0, 39

The l -coordinate of the vertex is 19.5. So, $l = 19.5$

$$\text{Then, } A = -\frac{2}{3}(19.5)(19.5 - 39)$$

$$A = 253.5$$

The maximum area is 253.5 m².

$$w = \frac{1}{3}(78 - 2(19.5))$$

$$w = 13$$

The dimensions that enclose the maximum area are 19.5 m by 13 m.

PTS: 0 DIF: Difficult

REF: 4.7 Modelling and Solving Problems with Quadratic Functions

LOC: 11.RF4 TOP: Relations and Functions

KEY: Communication | Problem-Solving Skills