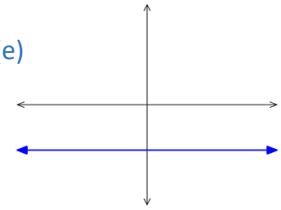
Chapter 2 Polynomial Functions REVIEW

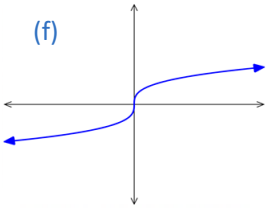
1. Which of the following are polynomial functions (include equations and graphs)

(a) $y = 2x^5 - 14x^2 + \sqrt{2}$ (b) $y = -5x^4 - 14x^{-1} + 1$ (c) $y = 2(5)^x - 2$ (d) $y = 2x^2 - 5\sqrt{x}$

(e)



(f)



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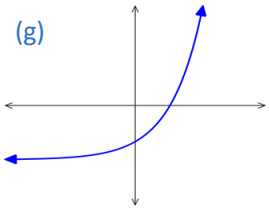
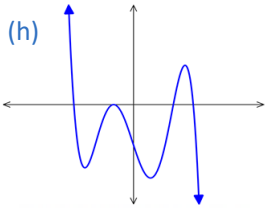


(h)



2. For each of the following polynomial functions, determine the following characteristics without using your calculator and without factoring.

i - The start and end behavior of the graph

ii - Whether or not the graph will have a minimum or maximum point

iii - The domain of the function and the y-intercept

Use your graphing calculator to determine:

iv - The range of the function (round to the nearest hundredth)

(a) $\boldsymbol{y = -4x^4 - 40x^3 - 77x^2 + 109x - 30}$

i - Start / end

ii - Max or min?

iii - Domain:
y-intercept:

iv - Range:

(b) $\boldsymbol{y = 3x^5 + 14x^4 - x^3 - 60x^2 - 36x}$

i - Start / end

ii - Max or min?

iii - Domain:
y-intercept:

iv - Range:

3. Divide each of the following polynomials, using either long division or its synthetic counterpart. Express results in the form $P = Q \times D + R$

(a) $(2x^3 + 9x^2 - 6x - 40) \div (x + 1)$ (b) $(2x^4 - 11x^3 + 6x^2 + 45x - 54) \div (2x - 3)$

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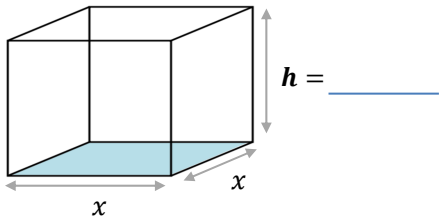
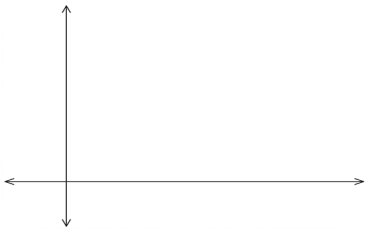
4. A package for mailing must have dimensions where sum of its height and the perimeter of the base is no more than 96 cm. Find the dimensions of the box of maximum volume that can be sent if the base is a square.



(a) Determine a function that represents the Volume of the box.

(b) Use technology to graph the function obtained in (b) with a suitable viewing window.

Provide your sketch below, labeling any max/mins and intercepts..



(c) Provide a domain and range for your function obtained in (b), with respect to the "real world" constraints of the problem.

Domain: _____ Range: _____

(d) State the maximum volume of the box that can be sent.

(e) State the dimensions for the box that provides the maximum volume.

5. Use the remainder theorem to find the remainder when:

(a) $2x^3 + 9x^2 - 6x - 40$ is divided by $(x - 2)$

(b) $8x^3 + 27$ is divided by $(2x - 3)$

6. Exam Style

NR

The same remainder is obtained when a polynomial function $P(x) = x^3 - bx^2 - 4x + 12$ is divided by $(x + 1)$ as when it's divided by $(x - 4)$.

The value of b is _____.

Answers to Review Questions from Previous Page

1. (a), (e), and (h) are polynomial functions

2. (a) i - Starts negative in quad III, ends neg in quad IV
ii - Maximum point iii - $\{x \in \mathbb{R}\}$ iv - $\{y | y \leq 36.25, y \in \mathbb{R}\}$

(b) i - Starts negative in quad III, ends pos in quad I
ii - No max / min iii - $\{x \in \mathbb{R}\}$ iv - $\{y \in \mathbb{R}\}$

3. (a) $2x^3 + 9x^2 - 6x - 40 = \mathbf{(2x^2 + 7x - 13)} \times (x + 1) - \mathbf{27}$

(b) $2x^4 - 11x^3 + 6x^2 + 45x - 54 = \mathbf{(x^3 - 4x^2 - 3x + 18)} \times (2x - 3) + \mathbf{0}$

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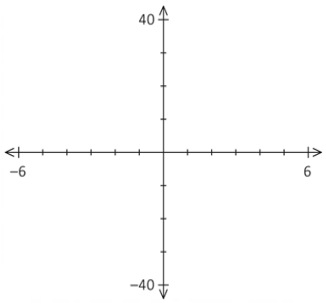
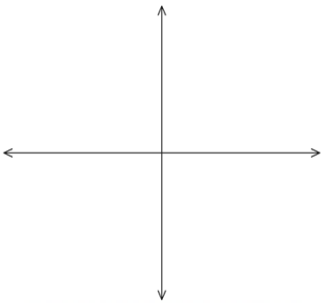
7. Use an algebraic process to **(i)** fully factor each of the following polynomial functions, showing all steps and processes. Then, **(ii)** state the zeros of each function. and **(iii)** provide a sketch of the graph, labelling all x and y intercepts.

(a) $y = x^3 - 2x^2 - 13x - 10$

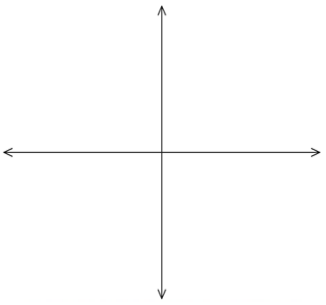


(b) $y = 2x^4 + 13x^3 + 21x^2 - 9x - 27$



Determine a suitable window on your own! Provide the scale you used here.

(c) $y = 2x^3 - x^2 + 2x + 5$



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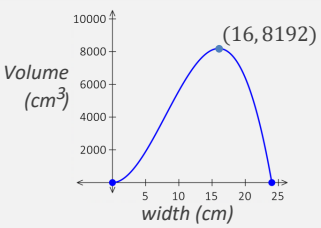
4. (a) $V = x^2(96 - 4x)$

(c) Domain: $[0, 24]$
Range: $[0, 8192]$

(d) Max V: $8192\ cm^3$

(e) 16 cm x 16 cm *base*, 32 cm *height*



5. (a) **0** (b) **54**

6. **3**

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8. Use the factor theorem to determine whether each of the following binomials are factors of $P(x) = 3x^4 + 13x^3 + 12x^2 - 12x - 16$:

(a) $(x + 2)$ (b) $(x - 3)$ (c) $(3x + 4)$

9. (a) Determine the value of k so that $\boldsymbol{x - 2}$ is a factor of $x^3 + kx^2 - x - 30$.

(b) Determine the value of k so that $\boldsymbol{x + 1}$ is a factor of $6x^5 - 5x^4 - 25x^3 + 10x^2 + kx$.

10. Exam Style

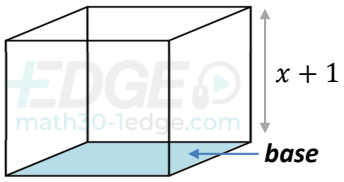
NR

The volume of the cube on the right can be expressed

$$\boldsymbol{V = 2x^3 - x^2 + kx - 20}$$

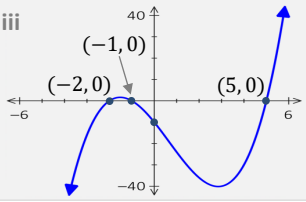
An expression that represents the area of the base is $\boldsymbol{ax^2 - bx - c}$, where the values of a, b, and c are, respectively: ____, ____ , and ____.

Note that $\boldsymbol{c}$ *is the last two digits of your answer*

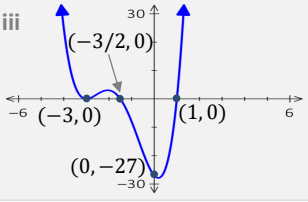


Answers to Review Questions from Previous Page

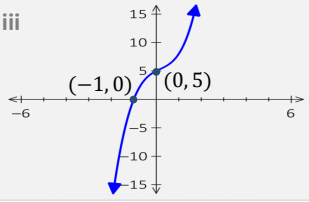
7. (a) i $\boldsymbol{y = (x + 2)(x + 1)(x - 5)}$
ii zeros: $\boldsymbol{-2, -1}$, and $\boldsymbol{5}$
iii



(b) i $\boldsymbol{y = (x - 1)(2x + 3)(x + 3)^2}$
ii zeros: $\boldsymbol{-3, -3/2}$, and $\boldsymbol{1}$
iii



(c) i $\boldsymbol{y = (x + 1)(2x^2 - 3x + 5)}$
ii zeros: $\boldsymbol{-1}$
iii



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11. $P(x)$ is a third-degree polynomial function where $P(3/2) = 0$, $P(-2) = 0$, and $P(0) = 6$.
Which of the binomials listed below could be a factor of $P(x)$?

Exam Style

A. $(x + 1)$
B. $(x - 1)$
C. $(x + 3)$
D. $(x - 3)$

12. Exam Style

The degree-four polynomial function $y = f(x)$ has zeros of $-3, -3/2, 1$, and 2, and $P(0) = -36$.

NR The value of $P\left(\frac{4}{3}\right)$, correct to the nearest hundredth, is _____.

13. Use an algebraic process to determine the exact roots of the equation $2x^3 - 10x^2 + 10x + 4 = 0$.

Answers to Review Questions from Previous Page

8. **(a)** and **(b)** are factors **9.** (a) **6** (b) **24** **10.** **2320**

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14. One of the steps in factoring the polynomial function $p(x) = x^3 - 13x^2 + 12$ is to express $p(x)$ as a product of $(x - 1)$ and which of the following factors?

Exam Style

A. $x^2 - 14x + 14$

B. $x^2 - 14x + 26$

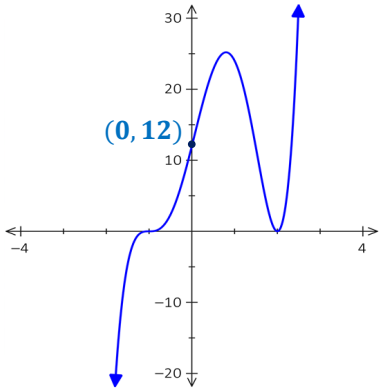
C. $x^2 - 12x - 12$

D. $x^2 - 12x + 12$

15. Exam Style **NR** The binomial $2x - 3$ is a factor of $g(x) = 2x^3 - x^2 - kx$ when k is equal to ____.

16. Exam Style Assuming a minimum degree, an equation for the polynomial function on the right is $P(x) = a(x + 1)^b(x - c)^d$.

NR The values of a, b, c, and d are, respectively, ___, ___, ____, and ___.



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11. B **12.** 10.91 **13.** $x = 2, \frac{3 - \sqrt{13}}{2}, \frac{3 + \sqrt{13}}{2}$

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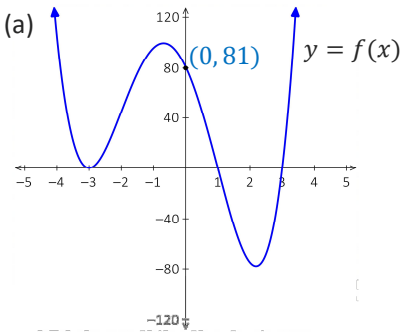
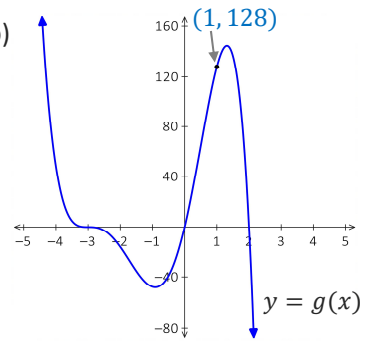
17. The graph of a polynomial functions, shown below, have integer x-intercepts.
Determine an equation for each function, in factored form and minimum degree.

(a)

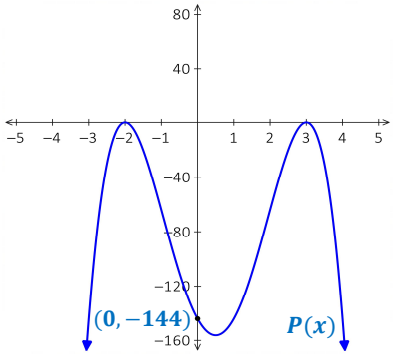


(b)



18. Exam Style

Assuming a minimum degree, an equation for the polynomial function on the right is $P(x) = -a(x+2)^b(x-c)^2$, where a, b, c, and $d \in N$.



NR The values of a, b, and c are, respectively, ___, ___, and ___.

Answers to Review Questions from Previous Page ***and this page***

14.	C	**15.**	3	**16.**	3322

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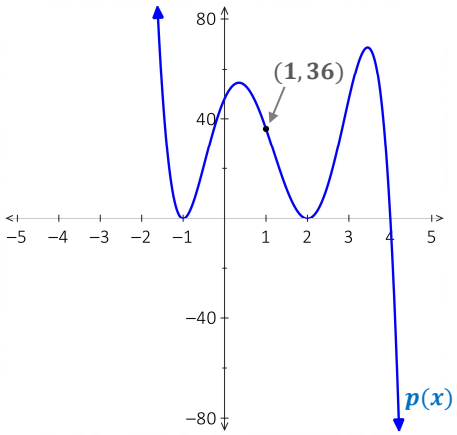
19. The graph of polynomial function $y = p(x)$, shown on the right, has three integer x-intercepts. Its equation can be written in the form:

$\boldsymbol{P(x) = ax^5 + bx^4 + cx^3 + dx^2 + ex + f}$; $a, b, c, d, e, \text{and } f$; $f \in I$

Determine the values of $\boldsymbol{a}$ and $\boldsymbol{f}$.

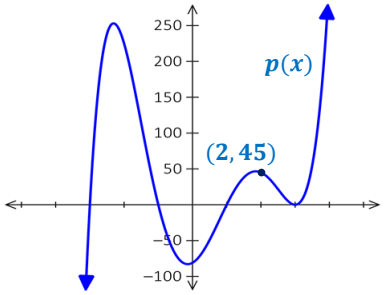


20. Exam Style

The graph of polynomial function $y = P(x)$, shown on the right, has four integer x-intercepts. Its equation can be written in the form:

$\boldsymbol{p(x) = (ax^2 + bx + c)(x + 3)(x + 1)(x - 3)}$; $a, b, c, d, e, \text{and } f$; $f \in I$

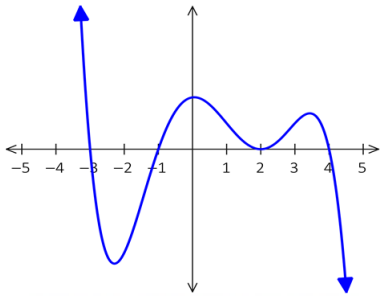
NR The values of $\boldsymbol{a}$, and $\boldsymbol{c}$ are, respectively, ___ and ___.



21. Exam Style

For the polynomial function $y = f(x)$, shown on the right, all x-intercepts have integer values and $g(3) = 6$.

NR The y-coordinate of the y-intercept is ____.



Answers to Review Questions from Previous Page

17. (a) $f(x) = 3(x+3)^2(x-1)(x-3)$ (b) $g(x) = -2x(x+3)^3(x-2)$ **18.** 423

19. $a = -3, f = 48$ **20.** 39 **21.** 12

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