MYP Alg II Unit 8 Polynomial Functions Exam review

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Rewrite the polynomial $12x^2 + 6 – 7x^5 + 3x^3 + 7x^4 – 5x$ in standard form. Then, identify the leading coefficient, degree, and number of terms. Name the polynomial.

a. $-7x^5 + 7x^4 + 3x^3 + 12x^2 - 5x + 6$
leading coefficient: –7; degree: 5; number of terms: 6; name: quintic polynomial

b. $6 - 5x + 12x^2 + 7x^3 + 3x^4 - 7x^5$
leading coefficient: 6; degree: 0; number of terms: 6; name: quintic polynomial

c. $6 - 5x + 12x^2 + 3x^3 + 7x^4 - 7x^5$
leading coefficient: 6; degree: 0; number of terms: 6; name: quintic polynomial

d. $-7x^5 + 7x^4 + 12x^3 + 3x^2 - 5x + 6$
leading coefficient: –7; degree: 5; number of terms: 6; name: quintic polynomial

____ 2. Add. Write your answer in standard form.
$(4d^5 - d^3) + (d^5 + 6d^3 - 4)$

a. $5d^5 + 5d^3 - 4$
b. $5d^5 + 5d^3$
c. $5d^{10} + 5d^6 - 4$
d. $4d^5 + 6d^3 - 4$

____ 3. A florist delivers flowers to anywhere in town. *d* is the distance from the delivery address to the florist shop in miles. The cost to deliver flowers, based on the distance *d,* is given by $C(d) = 0.04d^3 - 0.65d^2 + 3.5d + 9$. Evaluate $C(d)$ for $d = 6$ and $d = 11$, and describe what the values of the function represent.

a. $C(6) = 15.24$; $C(11) = 22.09$.
$C(6)$ represents the cost, \$15.24, of delivering flowers to a destination that is 6 miles from the shop.
$C(11)$ represents the cost, \$22.09, of delivering flowers to a destination that is 11 miles from the shop.

b. $C(6) = 22.09$; $C(11) = 15.24$.
$C(6)$ represents the cost, \$22.09, of delivering flowers to a destination that is 6 miles from the shop.
$C(11)$ represents the cost, \$15.24, of delivering flowers to a destination that is 11 miles from the shop.

c. $C(6) = 62.04$; $C(11) = 179.39$.
$C(6)$ represents the cost, \$62.04, of delivering flowers to a destination that is 6 miles from the shop.
$C(11)$ represents the cost, \$179.39, of delivering flowers to a destination that is 11 miles from the shop.

d. $C(6) = 23.43$; $C(11) = 49.62$.
$C(6)$ represents the cost, \$23.43, of delivering flowers to a destination that is 6 miles from the shop.
$C(11)$ represents the cost, \$49.62, of delivering flowers to a destination that is 11 miles from the shop.

____ 4. Graph the polynomial function $f(x) = -x^4 + 3x^3 + 2x^2 - 5x - 4$ on a graphing calculator. Describe the graph, and identify the number of real zeros.

a. From left to right, the graph alternately increases and decreases, changing direction two times. It crosses the x-axis three times, so there appear to be three real zeros.

b. From left to right, the graph increases and then decreases. It crosses the x-axis twice, so there appear to be two real zeros.

c. From left to right, the graph alternately increases and decreases, changing direction three times. It crosses the *x*-axis four times, so there appear to be four real zeros.

d. From left to right, the graph alternately increases and decreases, changing direction three times. It crosses the *x*-axis two times, so there appear to be two real zeros.

____ 5. For $h(x) = 2x^2 + 6x - 9$ and $k(x) = 3x^2 - 8x + 8$, find $h(x) - 2k(x)$.

a. $-4x^2 + 22x - 25$ c. $-4x^2 + 14x - 17$

b. $-4x^2 - 14x + 17$ d. $-4x^2 - 22x + 25$

____ 6. Find the product $2cd^4(-4c^6d^5 - c^3d)$.

a. $-2c^7d^9 + c^4d^5$ c. $2c^8d^{10} + 2c^5d^6$

b. $-8c^6d^{20} - 2c^3d^4$ d. $-8c^7d^9 - 2c^4d^5$

____ 7. Find the product $(5x - 3)(x^3 - 5x + 2)$.

a. $5x^4 - 3x^3 - 25x^2 + 25x - 6$ c. $5x^3 - 28x^2 + 25x - 6$

b. $5x^3 + 22x^2 - 5x - 6$ d. $5x^4 - 3x^3 + 25x^2 - 5x - 6$

____ 8. Ms. Ponce owns a company that makes specialized race car engines. From 1985 through 2005, the number of engines produced can be modeled by $N(x) = 6x^2 - 4x + 300$ where x is number of years since 1985. The average revenue per engine (in dollars) can be modeled by $R(x) = 30x^2 + 70x + 1,000$. Write a polynomial $T(x)$ that can be used to model Ms. Ponce's total revenue.

a. $180x^4 + 300x^3 + 14,720x^2 + 17,000x + 300,000$

b. $180x^4 - 280x^2 + 300,000$

c. $36x^4 + 66x^2 + 1,300$

d. $36x^4 + 39x^3 - 580x^2 + 9,700x + 15,300$

____ 9. Find the product $(x - 2y)^3$.

a. $x^3 - 6x^2y + 12xy^2 - 8y^3$ c. $x^3 - 8y^3$

b. $x^3 + 8y^3$ d. $x^3 + 6x^2y + 12xy^2 + 8y^3$

____ 10. Use Pascal's Triangle to expand the expression $(4x + 3)^4$.

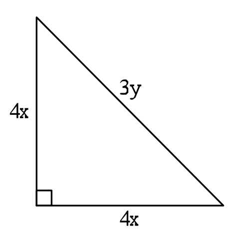
a. $20736x^4 + 6912x^3 + 864x^2 + 48x + 3$

b. $256x^4 + 768x^3 + 864x^2 + 432x + 81$

c. $256x^4 + 576x^3 + 432x^2 + 108x + 81$

d. $256x^4 + 192x^3 + 144x^2 + 108x + 81$

____ 11. The right triangle shown is enlarged such that each side is multiplied by the value of the hypotenuse, $3y$. Find the expression that represents the perimeter of the enlarged triangle.



a. $6y + 24xy$ c. $9y^2 + 24xy$

b. $9y^2 + 8xy$ d. $6y^2 + 24xy$

____ 12. Divide by using long division: $(5x + 6x^3 - 8) \div (x - 2)$.

a. $6x^2 + 12x + 29$
b. $6x^2 + 12x + 29 + \frac{50}{(x-2)}$
c. $6x^2 - 12x + 29 - \frac{64}{(x-2)}$
d. $6x^2 + 5 - \frac{8}{(x-2)}$

____ 13. Divide by using synthetic division.
$(x^2 - 9x + 10) \div (x - 2)$

a. $x - 9 + \frac{6}{x-2}$
b. $x - 11 + \frac{32}{x-2}$
c. $x - 7 + \frac{-4}{x-2}$
d. $2x - 18 + \frac{10}{x-2}$

____ 14. Use synthetic substitution to evaluate the polynomial $P(x) = x^3 - 4x^2 + 4x - 5$ for $x = 4$.

a. $P(4) = 11$
b. $P(4) = -53$
c. $P(4) = -149$
d. $P(4) = 149$

____ 15. Write an expression that represents the width of a rectangle with length $x + 5$ and area $x^3 + 12x^2 + 47x + 60$.

a. $x^2 + 7x + 12$
b. $x^2 + 17x + 132 + \frac{720}{x+5}$
c. $x^2 + 17x - 38 - \frac{50}{x+5}$
d. $x^3 + 7x^2 + 12x$

____ 16. Determine whether the binomial $(x - 4)$ is a factor of the polynomial $P(x) = 5x^3 - 20x^2 - 5x + 20$.

a. $(x - 4)$ is not a factor of the polynomial $P(x) = 5x^3 - 20x^2 - 5x + 20$.
b. $(x - 4)$ is a factor of the polynomial $P(x) = 5x^3 - 20x^2 - 5x + 20$.
c. Cannot determine.

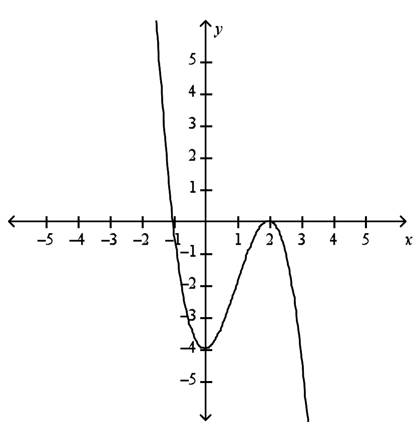
____ 17. Factor $x^3 + 5x^2 - 9x - 45$.

a. $(x - 5)(x^2 + 9)$
b. $(x - 5)(x - 3)(x + 3)$
c. $(x + 5)(x - 3)(x + 3)$
d. $(x + 5)(x^2 + 9)$

____ 18. Factor the expression $81x^6 + 24x^3y^3$.

a. $3x^3(3x + 2y)(9x^2 - 6xy + 4y^2)$
b. $3x^3(3x + 2y)^3$
c. $3x^3(3x + 2y)(9x^2 + 6xy + 4y^2)$
d. $3x^3(27x^3 + 8y^3)$

____ 19. Computer graphics programs often employ a method called *cubic splines regression* to smooth hand-drawn curves. This method involves splitting a hand-drawn curve into regions that can be modeled by cubic polynomials. A region of a hand-drawn curve is modeled by the function $f(x) = -x^3 + 3x^2 - 4$. Use the graph of $f(x) = -x^3 + 3x^2 - 4$ to identify the values of x for which $f(x) = 0$ and to factor $f(x)$.



a. $x = -1;\ x = 2;\ f(x) = -(x+1)(x-2)^2$
b. $x = -1;\ x = 2;\ f(x) = -(x+1)^2(x-2)$
c. $x = -1;\ x = 2;\ f(x) = (x+1)(x-2)^2$
d. $x = 1;\ x = -2;\ f(x) = -(x-1)^2(x+2)$

____ 20. Factor $(2x-1)^3 - 27$ as the difference of two cubes. Then, simplify each factor.
a. $(2x-4)(4x^2+2x+7)$
b. $(2x-4)(2x-3)(2x+4)$
c. $(2x-4)(2x+2)^2$
d. $(2x-4)(4x^2-10x+13)$

____ 21. Solve the polynomial equation $3x^5 + 6x^4 - 72x^3 = 0$ by factoring.
a. The roots are –6 and 4.
b. The roots are 0, –6, and 4.
c. The roots are 0, 6, and –4.
d. The roots are –18 and 12.

____ 22. Identify the roots of $-3x^3 - 21x^2 + 72x + 540 = 0$. State the multiplicity of each root.
a. $x-5$ is a factor once, and $x+6$ is a factor twice.
The root 5 has a multiplicity of 1, and the root -6 has a multiplicity of 2.
b. $x+5$ is a factor once, and $x-6$ is a factor twice.
The root 5 has a multiplicity of 1, and the root -6 has a multiplicity of 2.
c. $x-5$ is a factor once, and $x+6$ is a factor twice.
The root -5 has a multiplicity of 1, and the root 6 has a multiplicity of 2.
d. $x+5$ is a factor once, and $x-6$ is a factor twice.
The root -5 has a multiplicity of 1, and the root 6 has a multiplicity of 2.

____ 23. A jewelry box has a length that is 2 inches longer than the width and a height that is 1 inch smaller than the width. The volume of the box is 140 cubic inches. What is the width of the jewelry box?
a. 5 in.
b. 2 in.
c. 4 in.
d. 6 in.

____ 24. Identify all of the real roots of $4x^4 + 31x^3 - 4x^2 - 89x + 22 = 0$.
a. -2 and $\frac{1}{4}$
b. $-2,\ \frac{1}{4},\ -3 + 2\sqrt{5},\ -3 - 2\sqrt{5}$
c. $\pm 1,\ \pm\frac{1}{2},\ \pm\frac{1}{4},\ \pm 2,\ \pm 11,\ \pm\frac{11}{2},\ \pm\frac{11}{4}$
d. $-2,\ \frac{1}{4},\ 3 + 2\sqrt{5},\ 3 - 2\sqrt{5}$

____ 25. Write the simplest polynomial function with zeros –2, 7, and $-\frac{1}{2}$.
a. $P(x) = x^3 - \frac{9}{2}x^2 + \frac{9}{2}x - 7$
b. $P(x) = x^3 + \frac{9}{2}x^2 + \frac{9}{2}x + 7$
c. $P(x) = x^4 - \frac{7}{2}x^3 + 0x^2 - \frac{5}{2}x - 7$
d. $P(x) = x^3 - 2x^2 + 7x - \frac{1}{2}$

____ 26. Solve $x^4 - 3x^3 - x^2 - 27x - 90 = 0$ by finding all roots.
a. The solutions are 5 and -2.
b. The solutions are 5, -2, $3i$, and $-3i$.
c. The solutions are -3, -1, -27, and -90.
d. The solutions are -5, 2, $3i$, and $-3i$.

____ 27. Write the simplest polynomial function with the zeros $2 - i$, $\sqrt{5}$, and -2.
a. $P(x) = x^5 - 2x^4 - 8x^3 + 20x^2 + 15x - 50 = 0$
b. $P(x) = x^5 - 2x^4 - 10x^3 + 16x^2 + 25x - 30 = 0$
c. $P(x) = x^5 - 2x^4 - 8x^3 - 20x^2 - 65x - 50 = 0$
d. $P(x) = x^6 - 4x^5 - 4x^4 + 36x^3 - 25x^2 - 80x + 100 = 0$

____ 28. A sugar cone packed with ice cream and topped with a scoop of ice cream is shaped approximately like a cone with hemispherical top. If the height of the sugar cone is 10 cm and the volume of ice cream is 96π cubic centimeters, find the radius of the sugar cone.

a. 5 cm
c. 3 cm
b. 4 cm
d. 5.5 cm

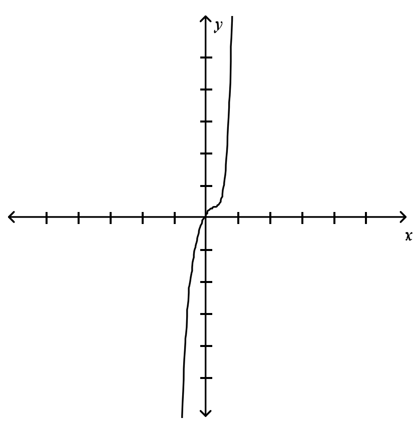
____ 29. What polynomial function has zeros 1, $1 + i$, and $1 - i$?

a. $P(x) = x^3 - 4x^2 + 3x - 1$
c. $P(x) = x^3 - 3x^2 + 4x - 2$
b. $P(x) = x^3 + 2x^2 - 3x - 3$
d. $P(x) = x^3 - x^2 + 2x + 1$

____ 30. Identify the leading coefficient, degree, and end behavior of the function $P(x) = -5x^4 - 6x^2 + 6$.

a. The leading coefficient is –5. The degree is 4.
As $x \to -\infty$, $P(x) \to -\infty$ and as $x \to +\infty$, $P(x) \to -\infty$
b. The leading coefficient is –5. The degree is 6.
As $x \to -\infty$, $P(x) \to -\infty$ and as $x \to +\infty$, $P(x) \to -\infty$
c. The leading coefficient is –5. The degree is 4.
As $x \to -\infty$, $P(x) \to +6$ and as $x \to +\infty$, $P(x) \to +6$
d. The leading coefficient is –5. The degree is 6.
As $x \to -\infty$, $P(x) \to +6$ and as $x \to +\infty$, $P(x) \to +6$

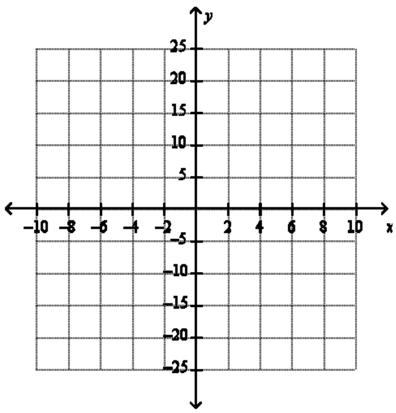
____ 31. Identify whether the function graphed has an odd or even degree and a positive or negative leading coefficient.



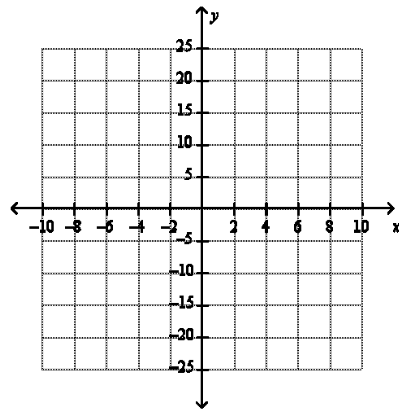
a. The degree is odd, and the leading coefficient is negative.
b. The degree is even, and the leading coefficient is negative.
c. The degree is even, and the leading coefficient is positive.
d. The degree is odd, and the leading coefficient is positive.

____ 32. Graph the function $f(x) = x^3 + 3x^2 - 6x - 8$.

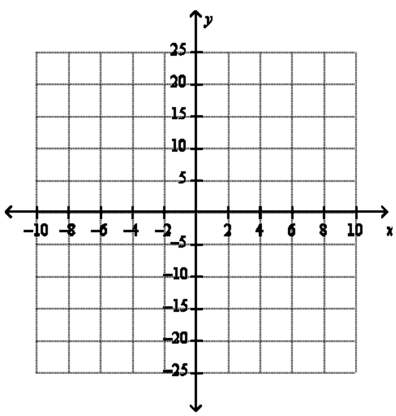
a.



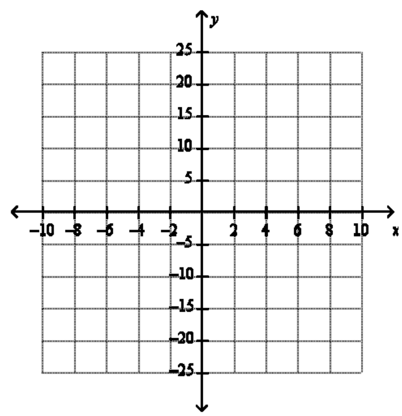
c.



b.



d.



____ 33. Graph $g(x) = 4x^3 - 24x + 9$ on a calculator, and estimate the local maxima and minima.

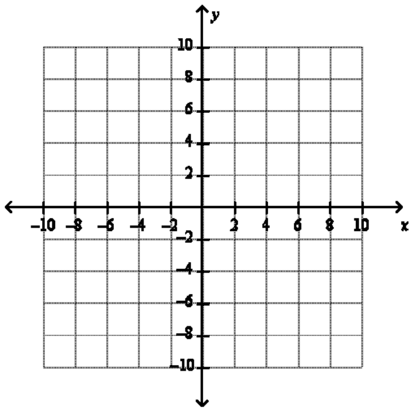
a. The local maximum is about –13.627417. The local minimum is about 31.627417.
b. The local maximum is about 31.627417. The local minimum is about –13.627417.
c. The local maximum is about 13.627417. The local minimum is about –31.627417.
d. The local maximum is about 22.627417. The local minimum is about –22.627417.

____ 34. You want to create a box without a top from an $8\frac{1}{2}$ in. by 11 in. sheet of paper. You will make the box by cutting squares of equal size from the four corners of the sheet of paper. If you make the box with the maximum possible volume, what will be the length of the sides of the squares you cut out?

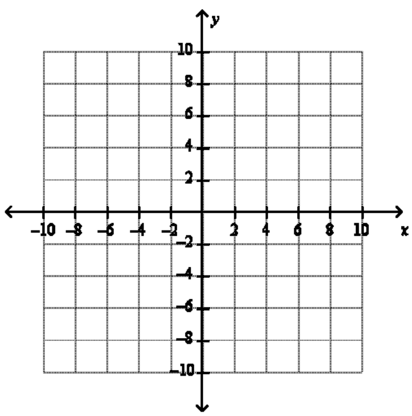
a. About 1.6 in.
b. About 2.8 in.
c. 66.2 in.
d. 61.3 in.

____ 35. For $f(x) = x^3 + 1$, write the rule for $g(x) = f(x) + 2$ and sketch its graph.

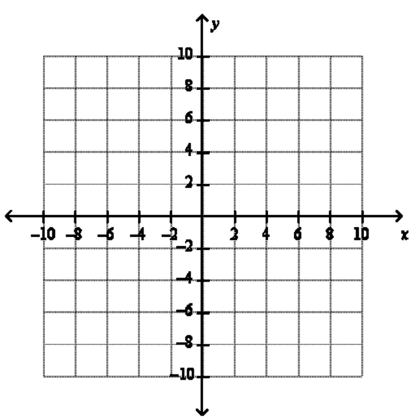
a. To graph $g(x) = f(x) + 2$, translate the graph of $f(x)$ up 2 units.



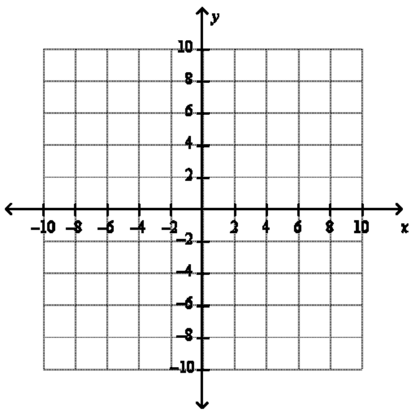
b. To graph $g(x) = f(x) + 2$, translate the graph of $f(x)$ right 2 units.



c. To graph $g(x) = f(x) + 2$, translate the graph of $f(x)$ left 2 units.



d. To graph $g(x) = f(x) + 2$, translate the graph of $f(x)$ down 2 units.



____ 36. Let $f(x) = 5x^3 + 7x^2 + 4x - 5$. Write a function g that reflects $f(x)$ across the y-axis.

a. $g(x) = -5x^3 - 7x^2 - 4x + 5$

b. $g(x) = -5x^3 - 7x^2 - 4x - 5$

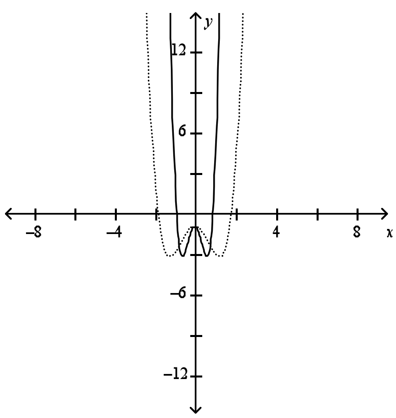
c. $g(x) = -5x^3 + 7x^2 - 4x + 5$

d. $g(x) = -5x^3 + 7x^2 - 4x - 5$

____ 37. Let $f(x) = x^4 - 3x^2 - 1$ and $g(x) = f(2x)$. Graph $f(x)$ and $g(x)$ on the same coordinate plane, and describe g as a transformation of f.

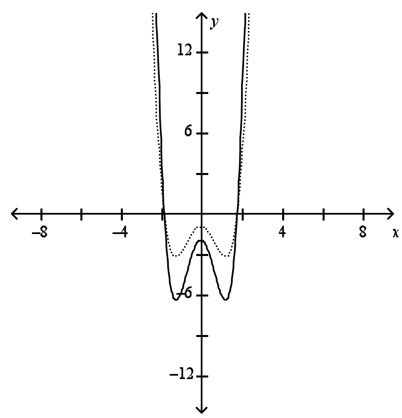
Here is the graph of $f(x)$.

a.



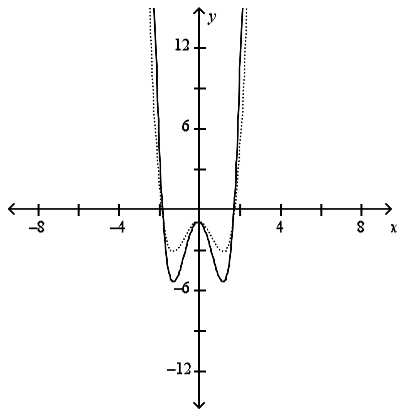
$g(x)$ is a horizontal compression of $f(x)$.

c.



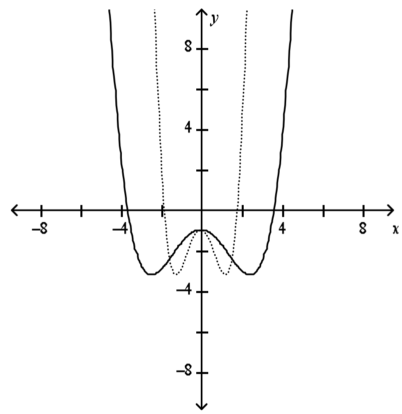
$g(x)$ is a vertical compression of $f(x)$.

b.



$g(x)$ is a vertical stretch of $f(x)$.

d.



$g(x)$ is a horizontal stretch of $f(x)$.

____ 38. Write a function that transforms $f(x) = 2x^3 + 4$ in the following way:

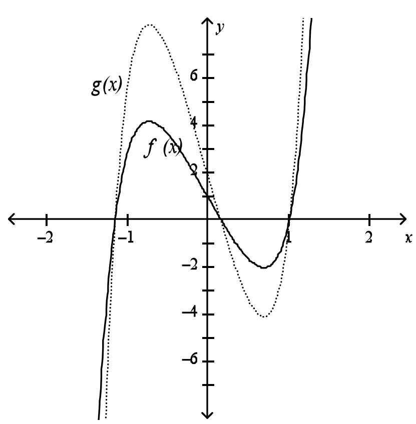
stretch vertically by a factor of 6 and shift 5 units left.

a. $g(x) = 12(x+5)^3 + 24$
b. $g(x) = 12x^3 + 9$
c. $g(x) = 12(x-5)^3 + 4$
d. $g(x) = 12(x+5)^3 + 4$

____ 39. The daily profit of a bicycle store can be modeled by $f(x) = x^3 - 5x^2 + 2x + 2$ where x is the number of bicycles sold. Let $g(x) = f(x+4)$. Find the rule for g, and explain the meaning of the transformation in terms of daily profit.

a. $g(x) = x^3 - 5x^2 + 2x + 6$
The shop makes the same profit after selling 4 fewer bicycles.
b. $g(x) = x^3 - 5x^2 + 2x + 6$
The shop makes the same profit after selling 4 fewer bicycles.
c. $g(x) = x^3 + 7x^2 + 10x - 6$
The shop makes the same profit after selling 4 more bicycles.
d. $g(x) = x^3 + 7x^2 + 10x - 6$
The shop makes the same profit after selling 4 fewer bicycles.

____ 40. Which description matches the transformation from $f(x)$ to $g(x)$ shown?



a. Vertical shift
c. Horizontal shift

b. Vertical stretch
d. Horizontal stretch

____ 41. Use finite differences to determine the degree of the polynomial that best describes the data.

x	–3	–1	1	3	5	7
y	–12	–7	–21	–51	–93	–142

a. The fourth differences are constant. A quartic polynomial best describes the data.
b. The third differences are constant. A cubic polynomial best describes the data.
c. The fifth differences are constant. A quintic polynomial best describes the data.
d. None of the differences is constant.

____ 42. The table shows the population of endangered tigers from year 0 (when the study began) to year 20. Write a polynomial function for the data.

Year	0	5	10	15	20
Population	280	437	571	781	1164

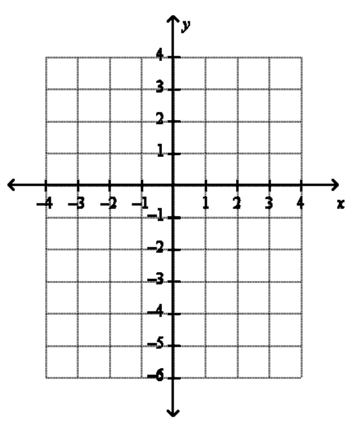
a. $f(x) \approx 0.13x^3 - 2.39x^2 + 40x + 280$
b. No polynomial function models the data.
c. $f(x) \approx 42.24x + 224.2$
d. $f(x) \approx 2.7x^2 - 1.5x + 250$

____ 43. The table shows the number of supporters of a local political candidate at various times (measured in weeks) before the election. Use a polynomial function to estimate the number of supporters the candidate had 5 weeks before the election.

Time (weeks)	0	1	2	3	6	7	8	9
Supporters	2927	2263	4030	4481	2209	1969	1667	1690

a. 3,908 supporters
c. 3,194 supporters
b. 3,046 supporters
d. 2,328 supporters

____ 44. What quartic function does the graph represent?



a. $f(x) = (x + 2)(2x + 1)(2x - 1)(2x - 3)$
b. $f(x) = (x - 2)(2x - 1)(2x + 1)(2x + 3)$
c. $f(x) = (x + 2)(\frac{1}{2}x + 1)(\frac{1}{2}x - 1)(\frac{1}{2}x - 3)$

d. $f(x) = (x - 2)(\frac{1}{2}x - 1)(\frac{1}{2}x + 1)(\frac{1}{2}x + 3)$

Numeric Response

45. Evaluate $D(x) = 4x^{10} + 6x^8 - 8x^7 - 2x^5 - 2x^4 - 7x^2 + 5$ for $x = -1$.

46. Identify the value of k that makes $x = -5$ a solution to $x^3 + 3x^2 - x + k = 0$.

47. How many turning points will a cubic function with three real zeros have?

MYP Alg II Unit 8 Polynomial Functions Exam
Answer Section

MULTIPLE CHOICE

1. ANS: A

The standard form is written with the terms in order from highest to lowest degree.
In standard form, the degree of the first term is the degree of the polynomial.
The polynomial has 6 terms. It is a quintic polynomial.

	Feedback
A	Correct!
B	The standard form is written with the terms in order from highest to lowest degree.
C	The standard form is written with the terms in order from highest to lowest degree.
D	Find the correct coefficient of the *x*-cubed term.

PTS: 1 DIF: Average REF: Page 407 OBJ: 6-1.2 Classifying Polynomials
TOP: 6-1 Polynomials

2. ANS: A

$(4d^5 - d^3) + (d^5 + 6d^3 - 4)$

$= (4d^5 + 6d^3) + (-d^3 + d^5) + (-4)$ Identify like terms. Rearrange terms to get like terms together.

$= 5d^5 + 5d^3 - 4$ Combine like terms.

	Feedback
A	Correct!
B	Check that you have included all the terms.
C	When adding polynomials, keep the same exponents.
D	First, identify the like terms and rearrange these terms so they are together. Then, combine the like terms.

PTS: 1 DIF: Basic REF: Page 407
OBJ: 6-1.3 Adding and Subtracting Polynomials NAT: 12.5.3.c
STA: 2A.2.A TOP: 6-1 Polynomials

3. ANS: A

$C(6) = 0.04(6)^3 - 0.65(6)^2 + 3.5(6) + 9 = 15.24$

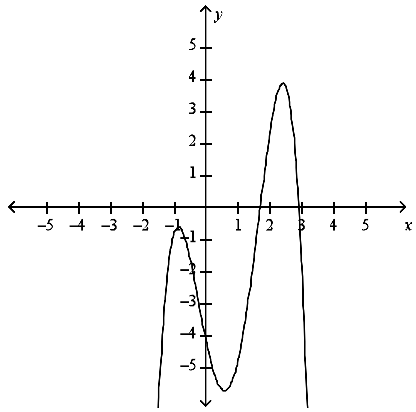
$C(11) = 0.04(11)^3 - 0.65(11)^2 + 3.5(11) + 9 = 22.09$

$C(6)$ represents the cost, $15.24, of delivering flowers to a destination that is 6 miles from the shop.
$C(11)$ represents the cost, $22.09, of delivering flowers to a destination that is 11 miles from the shop.

	Feedback
A	Correct!
B	You reversed the values of *C*(6) and *C*(11).
C	You added all the terms. There is a minus sign before 0.65.
D	Square the number of miles before multiplying by 0.65.

PTS: 1 DIF: Average REF: Page 408 OBJ: 6-1.4 Application
NAT: 12.5.3.c STA: 2A.2.A TOP: 6-1 Polynomials

4. ANS: D



From left to right, the graph alternately increases and decreases, changing direction three times. The graph crosses the *x*-axis two times, so there appear to be two real zeros.

	Feedback
A	How many times does the graph change direction? How many times does the graph cross the *x*-axis?
B	How many times does the graph change direction? How many times does the graph cross the *x*-axis?
C	How many times does the graph cross the *x*-axis?
D	Correct!

PTS: 1 DIF: Average REF: Page 409
OBJ: 6-1.5 Graphing Higher-Degree Polynomials on a Calculator
TOP: 6-1 Polynomials

5. ANS: A

$h(x) - 2k(x)$

$= 2x^2 + 6x - 9 - 2(3x^2 - 8x + 8)$ Substitute the given values.

$= 2x^2 + 6x - 9 - 6x^2 + 16x - 16$ Distribute.

$= -4x^2 + 22x - 25$ Simplify.

	Feedback
A	Correct!
B	Check for algebra mistakes. Multiply every term in *k*(*x*) by –2.
C	Check for algebra mistakes. Multiply every term in *k*(*x*) by –2.
D	Check for algebra mistakes. Multiplying by –2 changes the sign of every term in *k*(*x*).

PTS: 1 DIF: Advanced NAT: 12.5.3.c TOP: 6-1 Polynomials

6. ANS: D

Use the Distributive Property to multiply the monomial by each term inside the parentheses. Group terms to get like bases together, and then multiply.

	Feedback

A	Multiply the coefficients for each term; don't add.
B	When multiplying like bases, add the exponents.
C	Don't forget to multiply the coefficients for each term.
D	Correct!

PTS: 1 DIF: Basic REF: Page 414
OBJ: 6-2.1 Multiplying a Monomial and a Polynomial NAT: 12.5.3.c
STA: 2A.2.A TOP: 6-2 Multiplying Polynomials

7. ANS: A

$(5x-3)(x^3-5x+2)$

$= 5x(x^3-5x+2) - 3(x^3-5x+2)$ Distribute $5x$ and -3.

$= 5x(x^3) + 5x(-5x) + 5x(2) - 3(x^3) - 3(-5x) - 3(2)$ Distribute $5x$ and -3 again.

$= 5x^4 - 25x^2 + 10x - 3x^3 + 15x - 6$ Multiply.

$= 5x^4 - 3x^3 - 25x^2 + 25x - 6$ Combine like terms.

	Feedback
A	Correct!
B	Combine only like terms.
C	Combine only like terms.
D	Check the signs.

PTS: 1 DIF: Average REF: Page 414 OBJ: 6-2.2 Multiplying Polynomials
NAT: 12.5.3.c STA: 2A.2.A TOP: 6-2 Multiplying Polynomials

8. ANS: A

Total revenue is the product of the number of engines and the revenue per engine. $T(x) = N(x)R(x)$. Multiply the two polynomials using the distributive property.

$$
\begin{array}{r}
6x^2 - \quad 4x + \quad 300 \\
\times \quad 30x^2 + \quad 70x + \quad 1,000 \\
\hline
6,000x^2 - 4,000x + 300,000 \\
420x^3 - \quad 280x^2 + 21,000x \qquad\qquad \\
180x^4 - 120x^3 + \quad 9,000x^2 \qquad\qquad\qquad\qquad \\
\hline
180x^4 + 300x^3 + 14,720x^2 + 17,000x + 300,000
\end{array}
$$

	Feedback
A	Correct!
B	Multiply each of the terms in the first polynomial by each of the terms in the second polynomial.
C	First, multiply the coefficients. Then add the coefficients of like terms.
D	First, multiply the coefficients. Then add the coefficients of like terms.

PTS: 1 DIF: Average REF: Page 415 OBJ: 6-2.3 Application
NAT: 12.5.3.c TOP: 6-2 Multiplying Polynomials

9. ANS: A

Write in expanded form.
$(x-2y)(x-2y)(x-2y)$

Multiply the last two binomial factors.
$(x-2y)(x^2-4xy+4y^2)$

Distribute the first term, distribute the second term, and combine like terms.
$x^3-6x^2y+12xy^2-8y^3$

	Feedback
A	Correct!
B	To find the product, write out the three binomial factors and multiply in two steps.
C	To find the product, write out the three binomial factors and multiply in two steps.
D	Remember that the second term is negative.

PTS: 1 DIF: Average REF: Page 416
OBJ: 6-2.4 Expanding a Power of a Binomial NAT: 12.5.3.c
STA: 2A.2.A TOP: 6-2 Multiplying Polynomials

10. ANS: B
The coefficients for n = 4 or row 5 of Pascal's Triangle are 1, 4, 6, 4, and 1.
$(4x+3)^4$
$=\left[1(4x)^4(+3)^0\right]+\left[4(4x)^3(+3)^1\right]+\left[6(4x)^2(+3)^2\right]+\left[4(4x)^1(+3)^3\right]+\left[1(4x)^0(+3)^4\right]$
$=256x^4+768x^3+864x^2+432x+81$

	Feedback
A	The variable term and number term exponents must add to 4.
B	Correct!
C	Use row 5 from Pascal's Triangle.
D	Use the numbers from Pascal's Triangle as coefficients for each term.

PTS: 1 DIF: Average REF: Page 417
OBJ: 6-2.5 Using Pascal's Triangle to Expand Binomial Expressions
TOP: 6-2 Multiplying Polynomials

11. ANS: C
measure of leg 1 = $3y(4x)=12xy$
measure of leg 2 = $3y(4x)=12xy$
measure of hypotenuse = $3y(3y)=9y^2$

$P=9y^2+12xy+12xy$
$P=9y^2+24xy$

	Feedback
A	Multiply both side lengths and the hypotenuse by $3y$.
B	The perimeter is the sum of all the side lengths.
C	Correct!
D	Check for algebra mistakes.

PTS: 1 DIF: Advanced TOP: 6-2 Multiplying Polynomials

12. ANS: B

To divide, first write the dividend in standard form. Include missing terms with a coefficient of 0.

$6x^3 + 0x^2 + 5x - 8$

Then write out in long division form, and divide.

$$\begin{array}{r} 6x^2 + 12x + 29 \\ x-2 \overline{\smash{)}\, 6x^3 + 0x^2 + 5x - 8} \\ \underline{-(6x^3 - 12x^2)} \qquad\qquad \\ 12x^2 + 5x \qquad \\ \underline{-(12x^2 - 24x)} \qquad \\ 29x - 8 \\ \underline{-(29x - 58)} \\ 50 \end{array}$$

Write out the answer with the remainder to get $6x^2 + 12x + 29 + \frac{50}{(x-2)}$.

	Feedback
A	Remember to include the remainder in the answer.
B	Correct!
C	Be careful when subtracting the terms.
D	Remember to divide by the "–2".

PTS: 1 DIF: Average REF: Page 422

OBJ: 6-3.1 Using Long Division to Divide Polynomials NAT: 12.5.3.c

STA: 2A.2.A TOP: 6-3 Dividing Polynomials

13. ANS: C

For $(x-2)$, $a = 2$.

$$\begin{array}{r|rrr} 2 & 1 & -9 & 10 \\ & & 2 & -14 \\ \hline & 1 & -7 & \boxed{-4} \end{array}$$

Write the coefficients of the expression.
Bring down the first coefficient. Multiply and add each column.

Write the remainder as a fraction to get $x - 7 + \frac{-4}{x-2}$.

	Feedback
A	Multiply each column by the value '*a*'.
B	The value 'a' occurs in the divisor as '*x* – *a*'.
C	Correct!
D	Begin synthetic division at the second coefficient.

PTS: 1 DIF: Average REF: Page 423

OBJ: 6-3.2 Using Synthetic Division to Divide by a Linear Binomial

NAT: 12.5.3.c TOP: 6-3 Dividing Polynomials

14. ANS: A

Write the coefficients of the dividend. Use $a = 4$.

4	1	–4	4	–5
		4	0	16
	1	0	4	11

$P(4) = 11$

	Feedback
A	Correct!
B	Bring down the first coefficient.
C	Add each column instead of subtracting.
D	Write the coefficients in the synthetic division format. Some of them are negative numbers.

PTS: 1 DIF: Basic REF: Page 424 OBJ: 6-3.3 Using Synthetic Substitution
NAT: 12.5.3.c TOP: 6-3 Dividing Polynomials

15. ANS: A

$\text{Width} = \dfrac{\text{Area}}{\text{Length}}$.

$\text{width} = \dfrac{x^3 + 12x^2 + 47x + 60}{x + 5}$ Substitute.

Use synthetic division.

–5	1	12	47	60
		–5	–35	–60
	1	7	12	0

The width can be represented by $x^2 + 7x + 12$.

	Feedback
A	Correct!
B	When dividing by x + 5, divide by –5 in synthetic division.
C	Add each column instead of subtracting.
D	The degree of the polynomial quotient is always one less than the degree of the dividend.

PTS: 1 DIF: Average REF: Page 425 OBJ: 6-3.4 Application
NAT: 12.5.3.c TOP: 6-3 Dividing Polynomials

16. ANS: B

Find $P(4)$ by synthetic substitution.

4	5	−20	−5	20
		20	0	−20
	5	0	−5	0

Since $P(4) = 0$, $x - 4$ is a factor of the polynomial $P(x) = 5x^3 - 20x^2 - 5x + 20$.

	Feedback
A	$(x - r)$ is a factor of $P(x)$ if and only if $P(r) = 0$. Find $P(r)$ by synthetic substitution.
B	Correct!
C	$(x - r)$ is a factor of $P(x)$ if and only if $P(r) = 0$. Find $P(r)$ by synthetic substitution.

PTS: 1 DIF: Average REF: Page 430
OBJ: 6-4.1 Determining Whether a Linear Binomial is a Factor
NAT: 12.5.3.d STA: 2A.2.A TOP: 6-4 Factoring Polynomials

17. ANS: C

$(x^3 + 5x^2) + (-9x - 45)$ Group terms.

$= x^2(x + 5) - 9(x + 5)$ Factor common monomials from each group.

$= (x + 5)(x^2 - 9)$ Factor out the common binomial.

$= (x + 5)(x - 3)(x + 3)$ Factor the difference of squares.

	Feedback
A	Watch your signs when factoring.
B	Watch your signs when factoring.
C	Correct!
D	In the second group, factor out a negative number.

PTS: 1 DIF: Average REF: Page 431 OBJ: 6-4.2 Factoring by Grouping
NAT: 12.5.3.d STA: 2A.2.A TOP: 6-4 Factoring Polynomials

18. ANS: A

Factor out the GCF.

$3x^3(27x^3 + 8y^3)$

Write as a sum of cubes.

$3x^3((3x)^3 + (2y)^3)$

Factor.

$3x^3(3x + 2y)((3x)^2 - 6xy + (2y)^2) = 3x^3(3x + 2y)(9x^2 - 6xy + 4y^2)$

	Feedback
A	Correct!
B	Check the formula for the sum of cubes.
C	In a sum of cubes, the plus and minus signs alternate.
D	After factoring out the GCF, see if the result can be factored further.

PTS: 1 DIF: Basic REF: Page 431
OBJ: 6-4.3 Factoring the Sum or Difference of Two Cubes NAT: 12.5.3.d
STA: 2A.2.A TOP: 6-4 Factoring Polynomials

19. ANS: A

The graph indicates $f(x)$ has zeroes at $x = -1$ and $x = 2$. By the Factor Theorem, $(x + 1)$ and $(x - 2)$ are factors of $f(x)$. Use either root and synthetic division to factor the polynomial. Choose the root $x = -1$.

$$\begin{array}{r|rrrr} -1 & -1 & 3 & 0 & -4 \\ & & 1 & -4 & 4 \\ \hline & -1 & 4 & -4 & \boxed{0} \end{array}$$

$f(x) = (x+1)(-x^2+4x-4)$	Write $f(x)$ as a product.
$f(x) = -(x+1)(x^2-4x+4)$	Factor out –1 from the quadratic.
$f(x) = -(x+1)(x-2)^2$	Factor the perfect-square quadratic.

	Feedback
A	Correct!
B	After identifying the roots, use synthetic division to factor the polynomial.
C	The graph decreases as *x* increases. How is this represented in the function?
D	The Factor Theorem states that if r is a root of $f(x)$, then $x - r$, not $x + r$, is a factor of $f(x)$.

PTS: 1 DIF: Average REF: Page 432 OBJ: 6-4.4 Application
NAT: 12.5.3.d STA: 2A.2.A TOP: 6-4 Factoring Polynomials

20. ANS: A

$(2x-1)^3 - 3^3$	Rewrite the expression as a difference of cubes.
$= [(2x-1)-3][(2x-1)^2 + 3(2x-1) + 3^2]$	Use $a^3 - b^3 = (a-b)(a^2+ab+b^2)$.
$= (2x-4)(4x^2-4x+1+6x-3+9)$	Simplify.
$= (2x-4)(4x^2+2x+7)$	Combine like terms.

	Feedback
A	Correct!
B	Use the formula for factoring a difference of two cubes.
C	Use the formula for factoring a difference of two cubes.
D	Check your answer by multiplying the factors.

PTS: 1 DIF: Advanced NAT: 12.5.3.d TOP: 6-4 Factoring Polynomials

21. ANS: B

$3x^5 + 6x^4 - 72x^3 = 0$	Factor out the GCF, $3x^3$.
$3x^3\left(x^2+2x-24\right) = 0$	
$3x^3(x+6)(x-4) = 0$	Factor the quadratic.
$3x^3 = 0,\ x+6 = 0,\ x-4 = 0$	Set each factor equal to 0.
$x = 0,\ x = -6,\ x = 4$	Solve for *x*.

	Feedback
A	Set the GCF equal to zero.
B	Correct!
C	Set each factored expression equal to zero and solve.

D	Factor out the GCF first.

PTS: 1 DIF: Average REF: Page 438
OBJ: 6-5.1 Using Factoring to Solve Polynomial Equations STA: 2A.2.A
TOP: 6-5 Finding Real Roots of Polynomial Equations

22. ANS: A

$-3x^3 - 21x^2 + 72x + 540 = 0$

$-3x^3 - 21x^2 + 72x + 540 = -3(x-5)(x+6)(x+6)$

$x-5$ is a factor once, and $x+6$ is a factor twice.

The root 5 has a multiplicity of 1.

The root -6 has a multiplicity of 2.

	Feedback
A	Correct!
B	You reversed the operation signs of the factors. Also, if *x* – *a* is a factor of the equation, *a* is a root of the equation.
C	If *x* – *a* is a factor of the equation, then *a* is a root of the equation.
D	You reversed the operation signs of the factors.

PTS: 1 DIF: Average REF: Page 439 OBJ: 6-5.2 Identifying Multiplicity
TOP: 6-5 Finding Real Roots of Polynomial Equations

23. ANS: A

Let *x* be the width in inches. The length is $x+2$, and the height is $x-1$.

Step 1 Find an equation.

$x(x+2)(x-1) = 140$	Volume is the product of the length, width, and height.
$x^3 + x^2 - 2x = 140$	Multiply the left side.
$x^3 + x^2 - 2x - 140 = 0$	Set the equation equal to 0.

Step 2 Factor the equation, if possible.

Factors of –140: $\pm1, \pm2, \pm4, \pm5, \pm7, \pm10, \pm14, \pm20, \pm28, \pm35, \pm120, \pm140$. Rational Root Theorem

Use synthetic substitution to test the positive roots (length can't be negative) to find one that actually is a root.

$(x-5)(x^2 + 6x + 28) = 0$	The synthetic substitution of 5 results in a remainder of 0. 5 is a root.
$x = \dfrac{-6 \pm \sqrt{36 - 4(1)(28)}}{2(1)} = \dfrac{-6 \pm \sqrt{-76}}{2}$	Use the Quadratic Formula to factor $x^2 + 6x + 28$. The roots are complex.
Width = 5 in.	Width must be a positive real number.

	Feedback
A	Correct!
B	Remember to subtract 140 from both sides before finding a root.

C	Be careful using synthetic substitution.
D	6 is not a possible root.

PTS: 1 DIF: Average REF: Page 440 OBJ: 6-5.3 Application
TOP: 6-5 Finding Real Roots of Polynomial Equations

24. ANS: B

The possible rational roots are $\pm 1,\ \pm\frac{1}{2},\ \pm\frac{1}{4},\ \pm 2,\ \pm 11,\ \pm\frac{11}{2},\ \pm\frac{11}{4}$.

Test -2.

$$\begin{array}{r|rrrrr} -2 & 4 & 31 & -4 & -89 & 22 \\ & & -8 & -46 & 100 & -22 \\ \hline & 4 & 23 & -50 & 11 & \boxed{0} \end{array}$$

The remainder is 0, so -2 is a root.

Now test $\frac{1}{4}$.

$$\begin{array}{r|rrrr} \frac{1}{4} & 4 & 23 & -50 & 11 \\ & & 1 & 6 & -11 \\ \hline & 4 & 24 & -44 & \boxed{0} \end{array}$$

The remainder is 0, so $\frac{1}{4}$ is a root.

The polynomial factors to $(x+2)(x-\frac{1}{4})(4x^2+24x-44)$.

To find the remaining roots, solve $4x^2+24x-44=0$.
Factor out the common factor to get $4(x^2+6x-11)=0$.
Use the quadratic formula to find the irrational roots.

$$x=\frac{-6\pm\sqrt{36+44}}{2}=-3\pm 2\sqrt{5}$$

The fully factored equation is $(x+2)(4x-1)(x-(-3+2\sqrt{5}))(x-(-3-2\sqrt{5}))$.

The roots are $-2,\ \frac{1}{4},(-3\ +\ 2\sqrt{5}),(-3\ -\ 2\sqrt{5})$.

	Feedback
A	These are the two rational roots. There are also irrational roots.
B	Correct!
C	These are the possible rational roots. Use these to find the rational roots.
D	Be careful when finding the irrational roots.

PTS: 1 DIF: Average REF: Page 441
OBJ: 6-5.4 Identifying All of the Real Roots of a Polynomial Equation
TOP: 6-5 Finding Real Roots of Polynomial Equations

25. ANS: A

$P(x)=0$

$P(x)=(x+2)(x-7)(x+\frac{1}{2})$ — If r is a zero of $P(x)$, then $x-r$ is a factor of $P(x)$.

$P(x)=(x^2-5x-14)(x+\frac{1}{2})$ — Multiply the first two binomials.

$P(x)=x^3-\frac{9}{2}x^2+\frac{9}{2}x-7$ — Multiply the trinomial by the binomial.

	Feedback
A	Correct!
B	If *r* is a zero of *P*(*x*), then (*x* – *r*), not (*x* + *r*), is a factor of *P*(*x*).
C	The simplest polynomial with zeros *r*1, *r*2, and *r*3 is (*x* – *r*1)(*x* – *r*2)(*x* – *r*3).
D	If r is a zero of *P*(*x*), then (*x* – *r*) is a factor of *P*(*x*).

PTS: 1 DIF: Average REF: Page 445
OBJ: 6-6.1 Writing Polynomial Functions Given Zeros
TOP: 6-6 Fundamental Theorem of Algebra

26. ANS: B

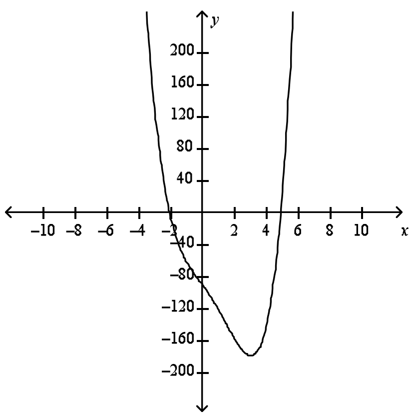
The polynomial is of degree 4, so there are four roots for the equation.

Step 1: Identify the possible rational roots by using the Rational Root Theorem.

$$\frac{\pm1, \pm2, \pm3, \pm5, \pm6, \pm9, \pm10, \pm15, \pm18 \pm30, \pm45, \pm90}{\pm1}$$

$p = -90$ and $q = 1$

Step 2: Graph $x^4 - 3x^3 - x^2 - 27x - 90 = 0$ to find the locations of the real roots.



The real roots are at or near 5 and -2.

Step 3: Test the possible real roots.

Test the possible root of 5:	Test the possible root of -2:
$\begin{array}{c\|ccccc} 5 & 1 & -3 & -1 & -27 & -90 \\ & & 5 & 10 & 45 & 90 \\ \hline & 1 & 2 & 9 & 18 & 0 \end{array}$	$\begin{array}{c\|ccccc} -2 & 1 & -3 & -1 & -27 & -90 \\ & & -2 & 10 & -18 & 90 \\ \hline & 1 & -5 & 9 & -45 & 0 \end{array}$

The polynomial factors into $(x-5)(x+2)(x^2+9) = 0$.

Step 4: Solve $x^2 + 9 = 0$ to find the remaining roots.

$x^2 + 9 = 0$

$x^2 = -9$

$x = \pm 3i$

The fully factored equation is $(x-5)(x+2)(x+3i)(x-3i)=0$.
The solutions are 5, -2, $-3i$, and $3i$.

	Feedback
A	The polynomial is of degree 4, so there are 4 roots.
B	Correct!
C	Graph the equation to find the locations of the real roots.
D	Set each factored expression equal to zero and solve!

PTS: 1 DIF: Average REF: Page 446
OBJ: 6-6.2 Finding All Roots of a Polynomial Equation
TOP: 6-6 Fundamental Theorem of Algebra

27. ANS: A

There are five roots: $2-i$, $2+i$, $\sqrt{5}$, $-\sqrt{5}$, and -2. (By the Irrational Root Theorem and Complex Conjugate Root Theorem, irrational and complex roots come in conjugate pairs.) Since it has 5 roots, the polynomial must have degree 5.

Write the equation in factored form, and then multiply to get standard form.

$P(x)=0$

$(x-(2-i))(x-(2+i))(x-\sqrt{5})(x-(-\sqrt{5}))(x-(-2))=0$

$(x^2-4x+5)(x^2-5)(x+2)=0$

$(x^4-4x^3+20x-25)(x+2)=0$

$P(x)=x^5-2x^4-8x^3+20x^2+15x-50=0$

	Feedback
A	Correct!
B	*i* squared is equal to –1, so the opposite is equal to 1.
C	$-4x(-5)=20x$
D	Only the irrational roots and the complex roots come in conjugate pairs. There are five roots in total.

PTS: 1 DIF: Average REF: Page 447
OBJ: 6-6.3 Writing a Polynomial Function with Complex Zeros
TOP: 6-6 Fundamental Theorem of Algebra

28. ANS: B

Write an equation to represent the volume of ice cream. Note that the hemisphere and the cone have the same radius, *x*.

$V=V_{cone}+V_{hemisphere}$

$$V_{cone}=\frac{1}{3}\pi x^2 h=\frac{1}{3}\pi x^2(10)=\frac{10}{3}\pi x^2$$

$$V_{hemisphere}=\frac{1}{2}V_{sphere}=\frac{1}{2}\left(\frac{4}{3}\pi x^3\right)=\frac{2}{3}\pi x^3$$

So,

$V(x) = \frac{10}{3}\pi x^2 + \frac{2}{3}\pi x^3$	
$96\pi = \frac{10}{3}\pi x^2 + \frac{2}{3}\pi x^3$	Set the volume equal to 96π.
$0 = \frac{2}{3}\pi x^3 + \frac{10}{3}\pi x^2 - 96\pi$	Write in standard form.
$0 = 2x^3 + 10x^2 - 288$	Multiply both sides by $\frac{3}{\pi}$.

The graph indicates a possible positive root of 4. Use synthetic division to verify that 4 is a root, and write the equation as $(x-4)(2x^2+18x+72)$. Since the discriminant of $2x^2+18x+72$ is -252, the roots of $2x^2+18x+72$ are complex. The radius must be a positive real number, so the radius of the sugar cone is 4 cm.

	Feedback
A	Write the total volume as the sum of the volume of a cone of height 10 cm and the volume of a hemisphere. Then solve for the radius.
B	Correct!
C	Write the total volume as the sum of the volume of a cone of height 10 cm and the volume of a hemisphere. Then solve for the radius.
D	Write the total volume as the sum of the volume of a cone of height 10 cm and the volume of a hemisphere. Then solve for the radius.

PTS: 1 DIF: Average REF: Page 447 OBJ: 6-6.4 Problem-Solving Application
TOP: 6-6 Fundamental Theorem of Algebra

29. ANS: C

$P(x) = 0$	
$(x-1)[x-(1+i)][x-(1-i)] = 0$	If r is a root of $P(x)$, then $x - r$ is a factor of $P(x)$.
$(x-1)(x-1-i)(x-1+i) = 0$	Distribute.
$(x-1)(x^2 - x + xi - x + 1 - i - ix + i + 1) = 0$	Multiply the trinomials. Use $-i^2 = 1$.
$(x-1)(x^2 - 2x + 2) = 0$	Combine like terms.
$x^3 - 2x^2 + 2x - x^2 + 2x - 2 = 0$	Multiply the binomial and trinomial.
$x^3 - 3x^2 + 4x - 2 = 0$	Combine like terms.

	Feedback
A	If r is a root of $P(x)$, then $(x - r)$ is a factor of $P(x)$.
B	First, multiply the factors. Then, combine like terms to get a polynomial function.
C	Correct!
D	If r is a root of $P(x)$, then $(x - r)$ is a factor of $P(x)$.

PTS: 1 DIF: Advanced TOP: 6-6 Fundamental Theorem of Algebra

30. ANS: A

The leading coefficient is –5, which is negative. The degree is 4, which is even.
So, as $x \to -\infty$, $P(x) \to -\infty$ and as $x \to +\infty$, $P(x) \to -\infty$.

	Feedback
A	Correct!

B	The degree is the greatest exponent.
C	For polynomials, the function always approaches positive infinity or negative infinity as *x* approaches positive infinity or negative infinity.
D	The degree is the greatest exponent.

PTS: 1 DIF: Basic REF: Page 454
OBJ: 6-7.1 Determining End Behavior of Polynomial Functions
TOP: 6-7 Investigating Graphs of Polynomial Functions

31. ANS: D

As $x \to -\infty$, $P(x) \to -\infty$ and as $x \to \infty$, $P(x) \to \infty$.
$P(x)$ is of odd degree with a positive leading coefficient.

	Feedback
A	The leading coefficient is positive if the graph increases as *x* increases and negative if the graph decreases as *x* increases.
B	The degree is even if the curve approaches the same *y*-direction as *x* approaches positive or negative infinity, and is odd if the curve increases and decreases in opposite directions. The leading coefficient is positive if the graph increases as *x* increases and negative if the graph decreases as *x* increases.
C	The degree is even if the curve approaches the same *y*-direction as *x* approaches positive or negative infinity, and is odd if the curve increases and decreases in opposite directions.
D	Correct!

PTS: 1 DIF: Basic REF: Page 454
OBJ: 6-7.2 Using Graphs to Analyze Polynomial Functions
TOP: 6-7 Investigating Graphs of Polynomial Functions

32. ANS: D

Step 1: Identify the possible rational roots by using the Rational Root Theorem. $p = –8$ and $q = 1$, so roots are positive and negative values in multiples of 2 from 1 to 8.

Step 2: Test possible rational zeros until a zero is identified.

Test $x = 1$.	Test $x = –1$.
$\begin{array}{r\|rrrr} 1 & 1 & 3 & -6 & -8 \\ & & 1 & 4 & -2 \\ \hline & 1 & 4 & -2 & -10 \end{array}$	$\begin{array}{r\|rrrr} -1 & 1 & 3 & -6 & -8 \\ & & -1 & -2 & 8 \\ \hline & 1 & 2 & -8 & 0 \end{array}$

$x = -1$ is a zero, and $f(x) = (x+1)(x^2 + 2x - 8)$.

Step 3: Factor: $f(x) = (x+1)(x-2)(x+4)$.
The zeros are –1, 2, and –4.

Step 4: Plot other points as guidelines.
$f(0) = -8$ so the *y*-intercept is – 8. Plot points between the zeros.
$f(1) = -10$ and $f(-3) = 10$

Step 5: Identify end behavior.

The degree is odd and the leading coefficient is positive, so as $x \to -\infty$, $P(x) \to -\infty$ and as $x \to +\infty$, $P(x) \to +\infty$.

Step 6: Sketch the graph by using all of the information about *f*(*x*).

	Feedback
A	The leading coefficient is positive, so *x* should go to negative infinity as *P*(*x*) goes to negative infinity.
B	The *y*-intercept should be the same as the last term in the equation.
C	The function is cubic, so should have 3 roots.
D	Correct!

PTS: 1 DIF: Average REF: Page 455
OBJ: 6-7.3 Graphing Polynomial Functions
TOP: 6-7 Investigating Graphs of Polynomial Functions

33. ANS: B
Step 1 Graph $g(x)$ on a calculator.
The graph appears to have one local maximum and one local minimum.

Step 2 Use the maximum feature of your graphing calculator to estimate the local maximum.
The local maximum is about 31.627417.

Step 3 Use the minimum feature of your graphing calculator to estimate the local minimum.
The local minimum is about –13.627417.

	Feedback
A	You reversed the values of the maximum and minimum.
B	Correct!
C	The constant is a positive number.
D	You forgot to add the constant of the function to the calculator.

PTS: 1 DIF: Average REF: Page 456
OBJ: 6-7.4 Determine Maxima and Minima with a Calculator
TOP: 6-7 Investigating Graphs of Polynomial Functions

34. ANS: A
Find a formula to represent the volume. Use *x* as the side length for the squares you are cutting out.

$$V(x) = x(8.5 - 2x)(11 - 2x)$$

Graph $V(x)$. Note that values of x less than 0 or greater than 4.25 do not make sense for this problem. The graph has a local maximum of about 66.1 when $x \approx 1.6$. So, the largest open box will have a volume of about 66.1 inches cubed when the sides of the squares are about 1.6 inches long.

	Feedback
A	Correct!
B	Find the *x*-value for the local maximum.
C	Find the *x*-value for the local maximum.
D	Find the *x*-value for the local maximum.

PTS: 1 DIF: Average REF: Page 456 OBJ: 6-7.5 Application
TOP: 6-7 Investigating Graphs of Polynomial Functions

35. ANS: A

$g(x) = f(x) + 2$

$g(x) = (x^3 + 1) + 2$

$g(x) = x^3 + 3$

To graph $g(x) = f(x) + 2$, translate the graph of $f(x)$ up 2 units. This is a vertical translation.

	Feedback
A	Correct!
B	$f(x) + c$ represents a vertical translation of $f(x)$.
C	$f(x) + c$ represents a vertical translation of $f(x)$.
D	The sign of c determines whether $f(x + c)$ represents a vertical translation of $f(x)$ $\|c\|$ units up or down.

PTS: 1 DIF: Average REF: Page 460
OBJ: 6-8.1 Translating a Polynomial Function
TOP: 6-8 Transforming Polynomial Functions

36. ANS: D

For a function g(x) that reflects $f(x)$ across the y-axis:

$g(x) = f(-x)$

$g(x) = 5(-x)^3 + 7(-x)^2 + 4(-x) - 5$

$g(x) = -5x^3 + 7x^2 - 4x - 5$

	Feedback
A	This is a reflection of $f(x)$ across the x-axis. To reflect across the y-axis, replace x with $(-x)$.
B	A negative number squared is a positive number.
C	The constant remains the same.
D	Correct!

PTS: 1 DIF: Average REF: Page 461
OBJ: 6-8.2 Reflecting Polynomial Functions
TOP: 6-8 Transforming Polynomial Functions

37. ANS: A

$g(x) = f(2x)$

$g(x) = (2x)^4 - 3(2x)^2 - 1$

$g(x) = 16x^4 - 12x^2 - 1$

	Feedback
A	Correct!
B	The transformation is inside the function; this makes a horizontal transformation.
C	The transformation is inside the function; this makes a horizontal transformation.

D	The function makes a different type of horizontal transformation.

PTS: 1 DIF: Average REF: Page 461
OBJ: 6-8.3 Compressing and Stretching Polynomial Functions
TOP: 6-8 Transforming Polynomial Functions

38. ANS: A

$g(x) = 6f(x + 5)$

$g(x) = 6(2(x + 5)^3 + 4)$

$g(x) = 12(x + 5)^3 + 24$

	Feedback
A	Correct!
B	The left shift value is added to the *x* value before it is cubed.
C	A shift to the left involves adding, not subtracting.
D	The vertical stretch factor will effect the y-intercept.

PTS: 1 DIF: Average REF: Page 462 OBJ: 6-8.4 Combining Transformations
TOP: 6-8 Transforming Polynomial Functions

39. ANS: D

$g(x) = f(x + 4)$

$g(x) = (x + 4)^3 - 5(x + 4)^2 + 2(x + 4) + 2$

$g(x) = x^3 + 12x^2 + 48x + 64 - 5x^2 - 40x - 80 + 2x + 8 + 2$

$g(x) = x^3 + 7x^2 + 10x - 6$

The transformation represents a horizontal shift left of 4 units, which corresponds to making the same profit for selling 4 fewer bicycles.

	Feedback
A	The transformation is $f(x + 4)$, not $f(x) + 4$.
B	The transformation is $f(x + 4)$, not $f(x) + 4$.
C	The transformation is a horizontal shift left.
D	Correct!

PTS: 1 DIF: Average REF: Page 462 OBJ: 6-8.5 Application
TOP: 6-8 Transforming Polynomial Functions

40. ANS: B

The *x*-intercepts are constant, so the transformation is not a horizontal shift or a horizontal stretch.

The graph of $g(x)$ is symmetric about the *x*-axis, so the transformation is not a vertical shift.
$g(x)$ has a higher maximum and a lower minimum than $f(x)$, showing a vertical stretch.
So the transformation is a vertical stretch.

	Feedback
A	The transformed function is symmetric about the *x*-axis, so the transformation is not a vertical shift.
B	Correct!
C	The *x*-intercepts are constant, so the transformation is not a horizontal shift.
D	The *x*-intercepts are constant, so the transformation is not a horizontal stretch.

PTS: 1 DIF: Advanced

41. ANS: A

The *x*-values increase by a constant, 2. Find the differences of the *y*-values.

y	–12	–7	–21	–51	–93	–142

First differences	5	–14	–30	–42	–49	Not constant
Second differences	–19	–16	–12	–7		Not constant
Third differences	3	4	5			Not constant
Fourth differences	1	1				Constant

The fourth differences are constant. A quartic polynomial best describes the data.

	Feedback
A	Correct!
B	Check your work. The third differences are not constant.
C	Check your work. The second differences are not constant.
D	To find the differences in the y-values, subtract each *y*-value from the *y*-value that follows it.

PTS: 1 DIF: Basic REF: Page 466
OBJ: 6-9.1 Using Finite Differences to Determine Degree
TOP: 6-9 Curve Fitting by Using Polynomial Models

42. ANS: A

Find the finite differences for the *y*-values.

Population	280	437	571	781	1164
First differences	157	134	210	383	
Second differences	–23	76	173		
Third differences	99	97			

The third differences of these data are not exactly constant, but because they are relatively close, a cubic function would be a good model.
Using the cubic regression feature on a calculator, the function is found to be:
$f(x) \approx 0.13x^3 - 2.39x^2 + 40x + 280$

	Feedback
A	Correct!
B	Find the differences between population values, stopping once you see relatively constant differences.
C	First differences are not relatively constant, so a linear model will not be a good fit.
D	Second differences are not relatively constant, so a quadratic model will not be a good fit.

PTS: 1 DIF: Average REF: Page 467
OBJ: 6-9.2 Using Finite Differences to Write a Function
TOP: 6-9 Curve Fitting by Using Polynomial Models

43. ANS: A
Let x represent the number of weeks before the election. Make a scatter plot of the data.
The function appears to be cubic or quartic. Use the regression feature to check the R^2-values.

cubic: $R^2 \approx 0.7402$ quartic: $R^2 \approx 0.8214$

The quartic function is a more appropriate choice.
The data can be modeled by
$f(x) = 8.16x^4 - 126.60x^3 + 466.66x^2 + 16.83x + 2649.93$
Substitute 5 for x in the quartic model.
$f(x) = 8.16(5)^4 - 126.60(5)^3 + 466.66(5)^2 + 16.83(5) + 2649.93 = 3675.58$
Based on the model, the number of supporters 5 weeks before the election was 3676.

	Feedback
A	Correct!
B	The quartic function is a more appropriate choice than the cubic function.
C	The quartic function is a more appropriate choice than the quadratic function.
D	The quartic function is a more appropriate choice than the exponential function.

PTS: 1 DIF: Average REF: Page 468 OBJ: 6-9.3 Application
TOP: 6-9 Curve Fitting by Using Polynomial Models

44. ANS: A

$f(x) = (x - a_1)(x - a_2)(x - a_3)(x - a_4)$	If r is a root of $P(x)$, then $x - r$ is a factor of $P(x)$.
$f(x) = \left[x - (-2)\right]\left[x - (-\frac{1}{2})\right]\left[x - (\frac{1}{2})\right]\left[x - (\frac{3}{2})\right]$	Substitute the roots from the graph.
$f(x) = (x + 2)(x + \frac{1}{2})(x - \frac{1}{2})(x - \frac{3}{2})$	Simplify.
$f(x) = (x + 2)(2x + 1)(2x - 1)(2x - 3)$	Multiply by 8 and simplify.

	Feedback
A	Correct!
B	Each factor of the polynomial subtracts a root from x.
C	Find the roots of the graph and subtract these values from x. Multiply these factors together to create the polynomial.
D	Find the zeros of the graph and subtract these values from x. Multiply these factors together to create the polynomial.

PTS: 1 DIF: Advanced TOP: 6-9 Curve Fitting by Using Polynomial Models

NUMERIC RESPONSE

45. ANS: 16

PTS: 1 DIF: Average TOP: 6-3 Dividing Polynomials

46. ANS: 45

PTS: 1 DIF: Advanced TOP: 6-5 Finding Real Roots of Polynomial Equations

47. ANS: 2

PTS: 1 DIF: Advanced TOP: 6-7 Investigating Graphs of Polynomial Functions