/45

Part A) Knowledge and Understanding

Multiple Choice (1 mark each)

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

1. An equation representing a function that extends from quadrant 3 to quadrant 1 is

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

2. The degree of the polynomial function $y = x^3 - 2x^2 + 5x - 1$ is

   a. 3
   b. 4
   c. 5
   d. 6

3. The graph of the polynomial function $y = (1 - x)(x - 2)^2$ extends from

   a. quadrant 2 to quadrant 1
   b. quadrant 2 to quadrant 4
   c. quadrant 3 to quadrant 1
   d. quadrant 3 to quadrant 4

4. Which of the following is an odd symmetry function?

   a. $y = 2x^3 - 3x^2$
   b. $y = -2x^5 - 2x^1$
   c. $y = 2x^3 - x + 1$
   d. none of these

5. The table of values represents a polynomial function.

x	y
-3	6
-2	2
-1	0
0	0
1	2
2	6

   The function is

   a. linear
   b. cubic
   c. quadratic
   d. quartic

6. Given the function $y = 2x^3 - 3x^2 - 5x + 1$, which finite differences will be equal (constant)?

   a. first differences
   b. second differences
   c. third differences
   d. sixth differences

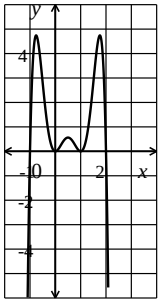
7. An equation for a quartic function with zeros 4, 5, and 6 that passes through the point (7, 18) is

   a. $y = (x - 6)^2(x - 4)(x - 5)$
   b. $y = (x - 4)^2(x - 5)(x - 6)$
   c. $y = (x - 4)(x - 5)(x - 6)$
   d. $y = ½(x - 4)(x - 5)^2(x - 6)^2$

8. The function $y = (x^4 + 1)(x^2 + 2)$ has how many x-intercepts?

a. 0
b. 1
c. 2
d. 3

9. State the interval(s) for which the graph of the function is negative.



a. $x \in (-\infty, -1)$ and $x \in (2, \infty)$
b. $x \in (-1, 2)$
c. $x \in (-1, 0)$ and $x \in (2, \infty)$
d. $x \in (-1, 0)$ and $x \in (0, 2)$

10. The area, A, in square metres, of a circular oil spill after t min is given by $A = \pi t^2$.
The average rate of change of the area of the oil spill over the first 5 min is approximately

a. 15 m^2/min
b. 16 m^2/min
c. 32 m^2/min
d. 75 m^2/min

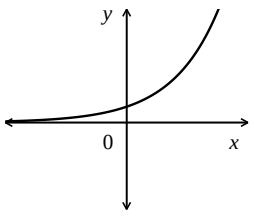
11. The number of people, P, at a playground after t min is given by $P = t^3 + 4t + 20$.
The instantaneous rate of change of the number of people at the playground after 1 min is approximately

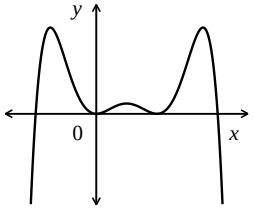
a. 5 people/min
b. 6 people/min
c. 7 people/min
d. 25 people/min

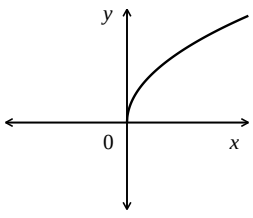
12. If the graph of the function $y = x^3$ is compressed horizontally by a factor of ½, stretched vertically by a factor of 3, and translated 5 units to the left, an equation for the graph of the transformed function is:
(Hint: the answer may have changed forms)

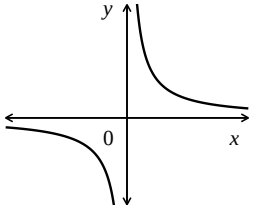
a. $y = 3[½(x + 5)]^3$
b. $y = 3[2(x - 5)]^3$
c. $y = 6(x + 5)^3$
d. $y = 24(x + 5)^3$

13. Which of the following graphs most likely represents a polynomial function?

a.


b.


c.


d.


14. The graph of the function $y = x^4$ is transformed to the graph of the function $y = -2(x - 3)^4 + 1$ by

a. a horizontal stretch by a factor of 2, a reflection in the x-axis, a translation of 3 units to the left, and a translation of 1 unit up

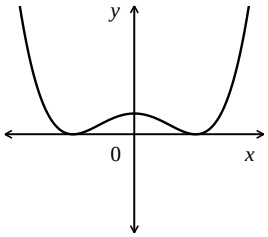
b. a vertical stretch by factor of 2, a reflection in the x-axis, a translation of 3 units to the left, and a translation of 1 unit up

c. a vertical stretch by a factor of 2, a reflection in the x-axis, a translation of 3 units to the right, and a translation of 1 unit up

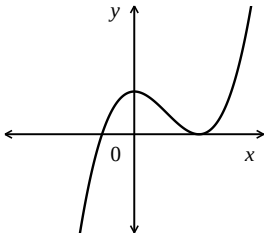
d. a vertical compression by a factor of ½, a reflection in the x-axis, a translation of 3 units to the left, and a translation of 1 unit up

15. Which of the following graphs represents the function $y = 2x^3 - 3x^4 + 1$?

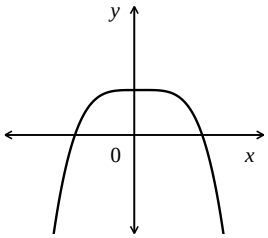
a.



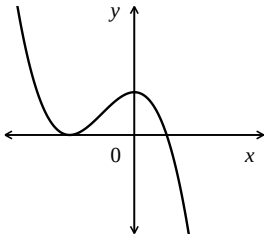
c.



b.



d.



16. Which of the following situations involves an average rate of change?

a. The noise level is increasing by 20 dB as she walks into the arena.

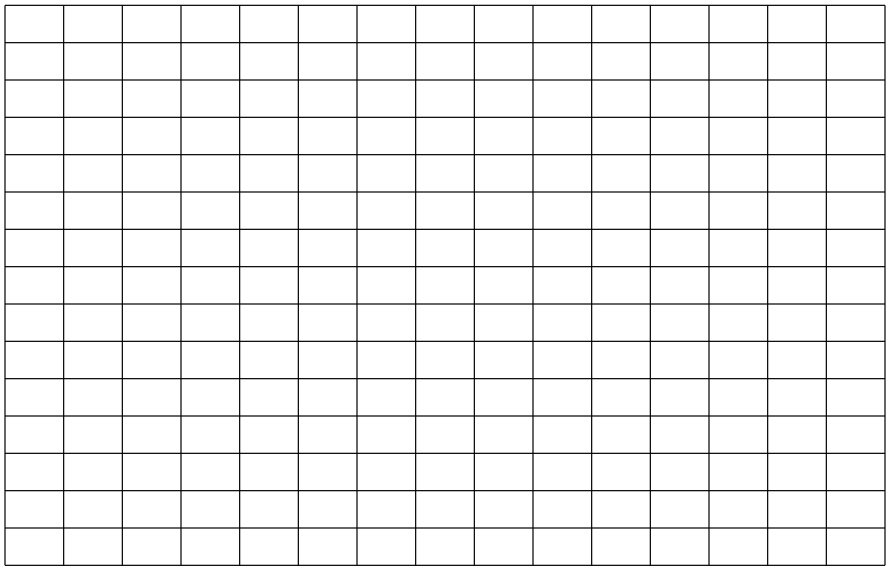
b. A car was driven for 1 h.

c. The temperature dropped 4°C at 6:00 p.m.

d. A child grew 2 cm in three years.

Part B) Applications

1. Use the end behaviours, zeros, and **y-intercept** to sketch $f(x) = -(x + 2)^3(x - 1)$ /3



2. Calculate the <u>fourth finite difference</u> for $f(x) = -5x^4 + 3x^2 - 9$ /2

3. The distance, d, in metres travelled by a boat from the moment it leaves shore can be modeled by the function $d(t) = 0.002t^3 + 0.05t^2 + 0.3t$, where t is the time in seconds

a) Find the average rate of change of the distance travelled between 5 and 10 seconds after leaving the shore. /2

b) Find the instantaneous rate of change 15 seconds after leaving the shore. /3

4. Determine the equation of the quartic function with zeros of -3, 0, and 2 (order 2), and that passes through the point (1,12)

/3

5. a) Describe the transformations to the curve $f(x) = x^3$ obtained by the function $g(x) = 2[-\frac{1}{2}(x - 3)]^3 + 1$ /3

b) Sketch the function $g(x) = 2[-\frac{1}{2}(x - 3)]^3 + 1$. **Include 3 exact points.** /2

Points

Part C) Communication

1. State the function $g(x)$ that is the function $f(x)$ transformed such that there is a reflection in the x-axis, a vertical compression by a factor of 1/3, a horizontal compression by a factor of 1/4, and a vertical shift down by 2 units.

/3

2. State the symmetry (even, odd, or neither) and the end behavior of each polynomial function. /3

a) $g(x) = 3x^3 - 8x^4$

b) $f(x) = 5x + 6x^3 + x^5$

c) $h(x) = x^4 - 3x^2 + 2$

Part D) Thinking, Inquiry and Problem Solving

1. **Predict the relationship** (provide two ideas) between the graphs of $f(x)$ and $g(x)$. /2

$$f(x) = x^3 - x^2$$

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

2. Find the point(s) of intersection of $f(x) = x^3 - x$ and $g(x) = -x^2 + x$ /3
(Hint: can find graphically or algebraically)

