

Mathematics 30-2 Name:

Chapter 5: Polynomial Functions

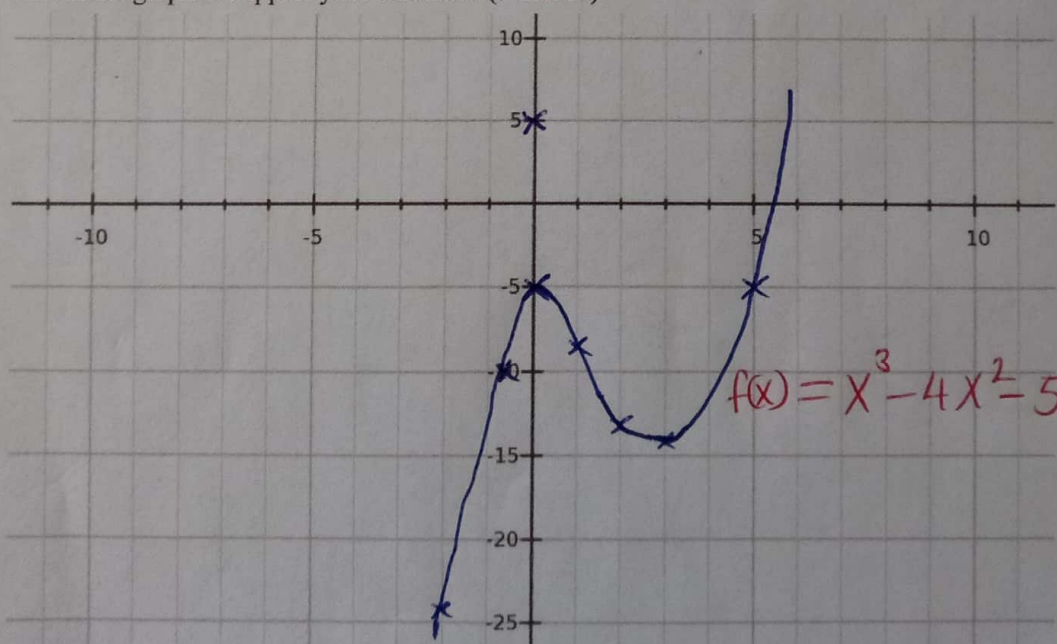
Assignment

Total: ____ / 32 marks

1. The possible number of x-intercepts that a cubic function can have is (1 mark)

- A. 0
 ✓ B. 3
 C. 1 or 2
 D. 1, 2 or 3

2. Determine the following characteristics of the polynomial function $f(x) = x^3 - 4x^2 - 5$.
 Sketch the graph to support your solutions. (3 marks)



x	y
0	-5
1	-8
2	-13
3	-14
4	-5

a) number of x-intercepts: 1b) y-intercept: 1

c) end behaviour: _____

d) domain: _____

Falls to the left and rises to the right
 $\{x | x \in \mathbb{R}\}$

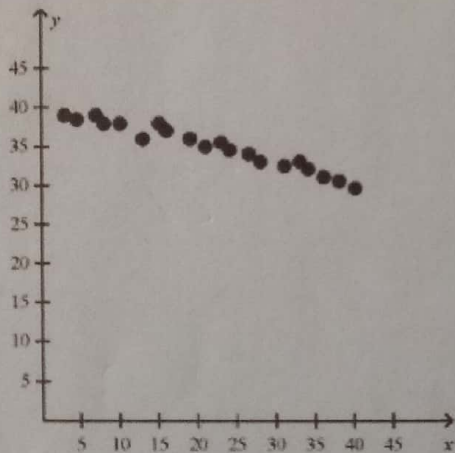
e) number of turning points: 2f) range: $(-\infty, \infty), \{y | y \in \mathbb{R}\}$

3. The volume of water in a cylindrical water tank being drained can be modelled by the function:
 $v(t) = -3.8t + 225$ where v represents the volume in litres and t represents the time in minutes.

How long will it take for the volume to get to 0 L? Round your answer to the nearest minute. (1 mark)

$$\begin{array}{l|l}
 v(t) = -3.8t + 225 & t = \frac{-225}{-3.8} \\
 0 = -3.8t + 225 & \\
 -3.8t = -225 & = 59.21 \text{ minutes} \\
 & \approx 59 \text{ minutes}
 \end{array}$$

4. Describe the characteristics of the trend in the data. (2 marks)



Degree of function: 1 Trend in data: linear

5. Describe the graph $y = x(x-3)^2$. Use the words, x-intercept(s), y-intercept, minimum, maximum, trend in the graph, domain and range in your description. (3 marks)

The graph has 2 x-intercepts at $(0, 0)$ and $(3, 0)$

The graph has one y-intercept at $(0, 0)$

The point $(3, 0)$ is the local minima

The point $(1, 4)$ is the local maxima

The graph falls to the left and rises to the right

The domain of the graph is $(-\infty, \infty), \{x | x \in \mathbb{R}\}$

The range of the graph is $(-\infty, \infty), \{y | y \in \mathbb{R}\}$

6. A snowboard company uses the relation: $P(x) = 210x - 60x^2$ to model its profits. In the model, P is the profit in thousands of dollars and x is the number of snowboards in thousands.

- a. How much profit should the company expect if they manufacture 2000 snowboards? (1 mark)

$$\begin{aligned} P(x) &= 210x - 60x^2 \\ &= (210 \times 2000) - (60 \times 2000^2) \end{aligned}$$

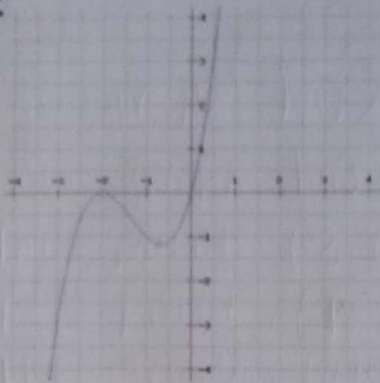
- b. The maximum profit of snowboards sold can be found at what point of the graph? (1 mark)

- A. x-intercept
- B. y-intercept
- C. origin
- ☒ D. vertex

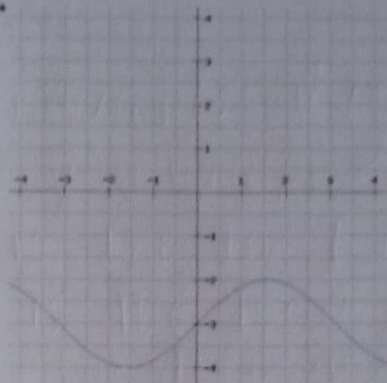
7. Which of the following graphs would most likely represent the graph of a cubic function. (1 mark)

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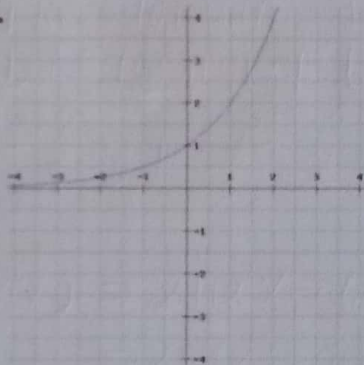
✓ A.



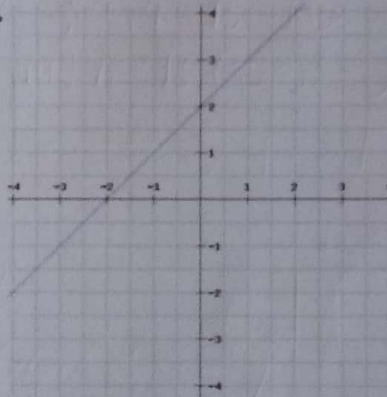
B.



C.

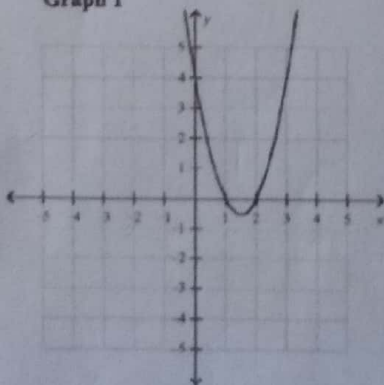


D.

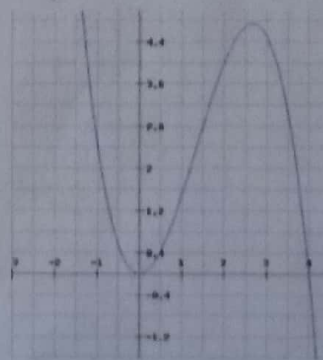


8. Identify the correct polynomial function for this graph. Justify your reasoning. (3 marks)

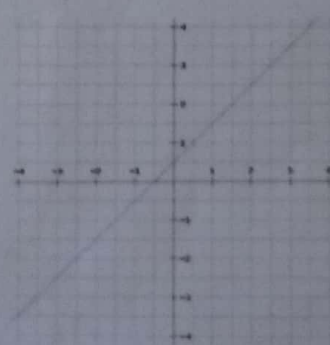
Graph 1



Graph 2



Graph 3



See answers next page

i) $y = -\frac{2}{3}x + 1$

iii) $y = -\frac{x^3 - 4x^2}{2}$

v) $y = 2(x-2)(x-1)$

ii) $y = -x^2 + x + 4$

iv) $y = \frac{1}{2} + x$

vi) $y = \frac{1}{3}(x^3 + x + 1)$

- a) Graph 1 matches Equation $y = 2(x-2)(x-1)$ because It is a quadratic graph that opens upward.
- b) Graph 2 matches Equation $y = \frac{x^3 - 4x^2}{2}$ because A cubic function
- c) Graph 3 matches Equation $y = \frac{1}{2} + x$ because The graph has a gradient of 1 and cuts y axis at the point $(0, \frac{1}{2})$

9. Write an equation for a polynomial function that satisfies each set of characteristics. Sketch the graph and state the degree of your polynomial. Explain your reasoning. (6 marks)

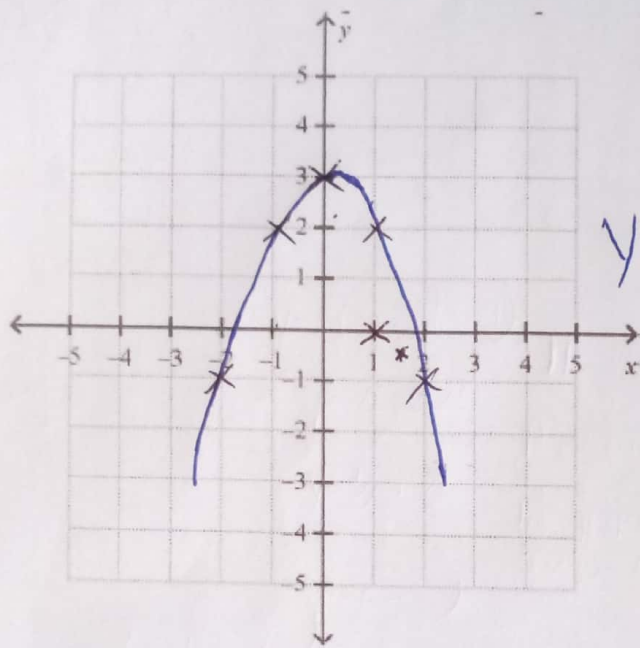
- a) one turning point, a maximum value, y-intercept of 3

~~$$y = \frac{3}{2}(x-2)(x-1)$$~~

Since parabolas are with one turning point, a maximum value of y implies y is of the form $y = a - x^2$.

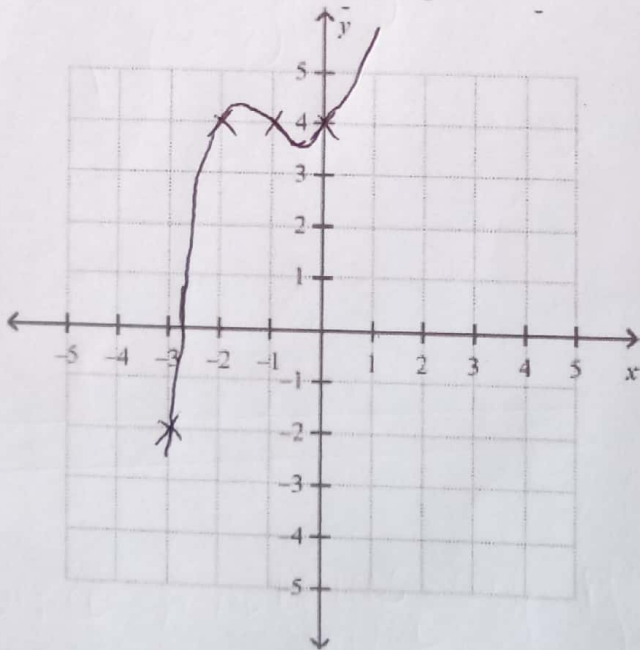
Now, y-intercept of 3 implies;

$$y = 3 - x^2$$



$$y = 3 - x^2$$

b) cubic, positive end direction, y-intercept of -4.



$$y = x^3 + 3x^2 + 2x + 4$$

10. Determine the equation of the linear regression function for the data. Round all values to the nearest hundredth. (1 mark)

x	10	20	30	40	50	80	100
y	-3.5	-1.2	0.2	-0.1	0.8	3.7	5.2

Equation of linear regression $\Rightarrow y = 0.09 - 3.42$

11. Determine the equation of the quadratic regression function for the data. Round all values to the nearest hundredth. (1 mark)

x	0	1	2	3	4	5	6	7	8
y	80	70	60	60	75	90	120	175	255

Quadratic regression function $\Rightarrow y = 2.31x^2 + 6.74x + 12.05$

12. Determine the equation of the cubic regression function for the data to the thousandth. Use the equation to extrapolate the value of y when x = 50. Round your answer to the nearest whole number. (2 marks)

x	5	10	15	20	25	30	35	40
y	211	236	255	258	264	267	276	291

Cubic regression function $\Rightarrow y = 0.005x^3 - 0.388x^2 + 10.227x + 168$

$y = 0.005x^3 - 0.388x^2 + 10.227x + 168.643$

When $x = 50$, $\Rightarrow 0.005(50^3) - 0.388(50^2) + 10.227(50) + 168.643$
 $625 - 970 + 511.35 + 168.643 = 334.993$
 ≈ 335

13. Shane tracked the depth of the water at an ocean marina one afternoon. His data is summarized in the table below.

Time of Day	12:00	13:00	14:00	15:00	16:00	18:00	19:00
Depth (ft)	12.3	12.7	13.3	13.8	14.3	14.6	14.3

a) Determine the equation for the cubic regression function that models this data. Let x be the number of hours since 12:00 and y be the depth in feet. (1 mark)

Equation of cubic regression

~~$= -0.025x^3 + 0.166x^2 + 0.243x + 12.309$~~

$\rightarrow y = -0.015x^3 + 0.095x^2 + 0.361x + 12.289$

- b) Interpolate the depth of the water at 17:00. Show your work. (1 mark)

17:00 represents 5

$$-0.015(5^3) + 0.095(5^2) + 0.361(5) + 12.289 = 14.594 \text{ ft}$$

- c) Extrapolate the depth of the water at 10:30 that morning. Show your work. (1 mark)

10:30 represents -1.5

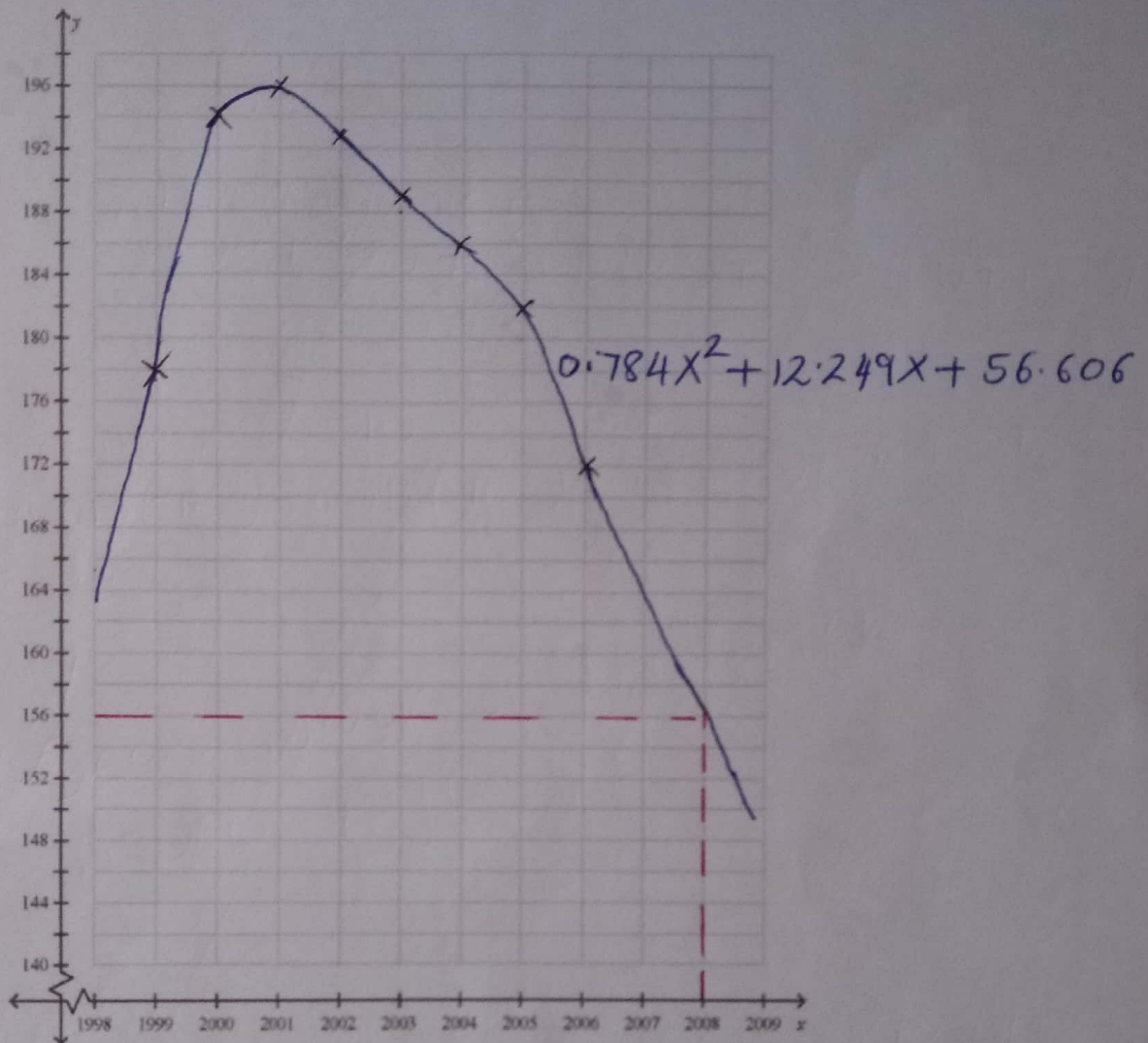
$$\Rightarrow -0.015(-1.5^3) + 0.095(-1.5^2) + 0.361(-1.5) + 12.289 = 12.011 \text{ ft}$$

14. A research company summarized the average time spent everyday by teenagers watching television.

Year	1999	2000	2001	2002	2003	2004	2005	2006
Time (min)	179	195	196	190	187	185	182	169

- a) Create a scatter plot, and draw a curve of best fit for the data using **quadratic** regression. (2 marks)

See answer on the graph
next page



b) Use your graph to estimate the average amount of time spent watching television in 2008.
(1 mark)

Year 2008

We use the graph to determine the number of T.V viewers that year.

From the graph, it is clear that the number of T.V viewers in 2008 is 156.