

PART 1 - CALCULATOR INACTIVE QUESTIONS

1. Below is a sketch of a polynomial. Determine:

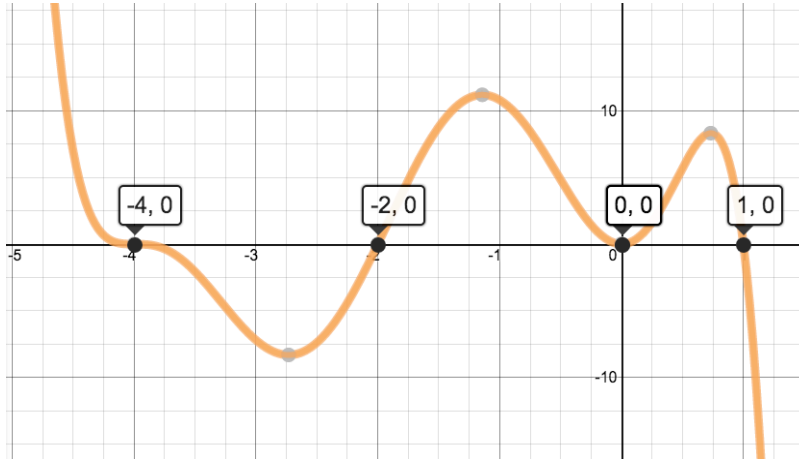
(8 marks)

a. The multiplicities of each zero. (2)

b. The degree of the polynomial. (1)

c. The sign of the leading coefficient. (1)

d. Write an equation of this polynomial in factored form. (4)



2. Solve each of the following equations using the ALGEBRAIC method of your choosing. **Show the key steps of your algebraic working in order to earn FULL CREDIT for correct answers.** (6 marks)

(a) $0 = 6(x - 7)^2 - 96$ (3M)

(b) $7x + 8 = 6x^2 + 5$ (3M)

3. You were presented with two special right triangles, with which you can answer the following questions that deal with the special angles and their ratios. **(6 marks)**

Draw the 30° - 60° - 90° right triangle here and label all sides and angles

Draw the 45° - 45° - 90° right triangle here and label all sides and angles

$$\sin^{-1}\left(\frac{\sqrt{3}}{2}\right) =$$

$$\tan(30^\circ) =$$

$$\cos(45^\circ) =$$

Solve the equation $2\sin(x) - 1 = 0$

If $f(x) = \cos(x)$, solve $f(x) = \frac{1}{2}$

If $f(x) = \tan(x)$, evaluate $f(60^\circ)$

4. Write the EQUATION of a parabola that has the following characteristics: (i) opens downward **AND** (ii) has no zeroes **AND** (iii) is wider than the parent function, $y = x^2$ **AND** (iv) has been translated to the right, compared to its parent function of $y = x^2$ (4 marks)

5. If the function $f(x) = 5 \sin(3x) - 4$ starts at $x = 0$ and complete 4 cycles, determine the period & amplitude & equation of the axis of the curve and the domain and range. (5 marks)

6. Mr. S. has been researching a computer software company, as he has made significant financial investments in this company. He knows that their annual revenues (sales) are modeled by the function $R(t) = 4t^2 + 2t + 980$. The company's annual expenses (costs) are modeled by the function $E(t) = 900 + 50t$ (where $t = 0$ is the years since the study began in 2000). (11 marks)

(a) Explain how we know from the model that the company's expenses are increasing. (1)

(b) The axis of symmetry of the quadratic function modeling the revenues is $t = -\frac{1}{2}$. Therefore, explain how we know that the revenues are increasing as well. (1)

(c) What might be one reason for the increase of a company's revenues and expenses. (1)

(d) What were the company's revenues and expenses at the beginning of the study (in the year 2000?) (2)

(e) When does the company break even in its **profits**? (5)

(f) During which years do the revenues **exceed** the expenses of the company? (1)

7. Give three plausible reasons why the graph below cannot possibly be the graph of $p(x) = x^4 + x^2 - 2$. (3 marks)



8. The rational function, $R(x)$, has a vertical asymptote at $x = -1/2$ and a horizontal asymptote at $y = -4$. Write a possible equation for $R(x)$. (3 marks)

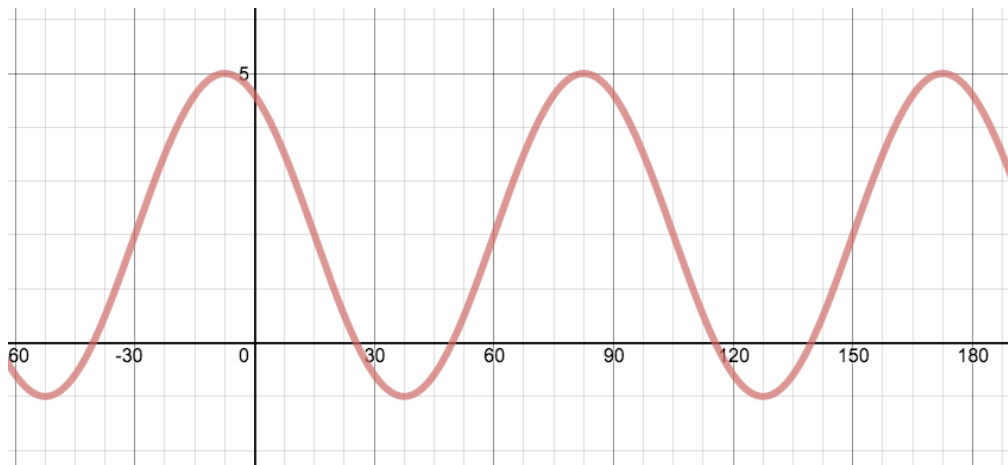
9. For each of the quadratic functions listed below, determine the optimal VALUE of each. (6 marks)

(a) $g(x) = 3x^2 + 12x - 8$ using completing the square

(b) $f(x) = -4x(x + 8) - 6$ using the method of your choosing

10. Here is a graph of a transformed sine function. Use this graph to state the amplitude, period, axis of the curve and then write the equation of this sinusoidal function (use sin OR cosine as you wish).

(5 marks)



11. Here is an equation of a polynomial: $f(x) = \frac{1}{2}(x - 4)^2(x - 2)^3(x + 1)(1 - x)$.

(8 marks)

- Determine the leading coefficient. (2)
- State the degree of the polynomial. (1)
- Determine the value of the y-intercept. (2)
- Sketch $f(x)$ (3)

12. Ms. A is throwing rocks around in the Waadi. She is standing on a cliff that is 25m high and can throw a rock so that it reaches a maximum height of 27m after 2 seconds.

(7 marks)

- Draw a sketch of the situation making sure to LABEL all key information. (2)
- Determine an equation that can be used to model the height of the rock, h in meters above the ground, as a function to time, t , in seconds since the rock was thrown. Use the variables h and t in your equation. (3)
- Ms. A believes that the rock hit the Waadi floor in about 9 or 10 seconds after she throws the rock. Provide any APPROPRIATE mathematical reasoning to explain why she is (or isn't) correct. (2)

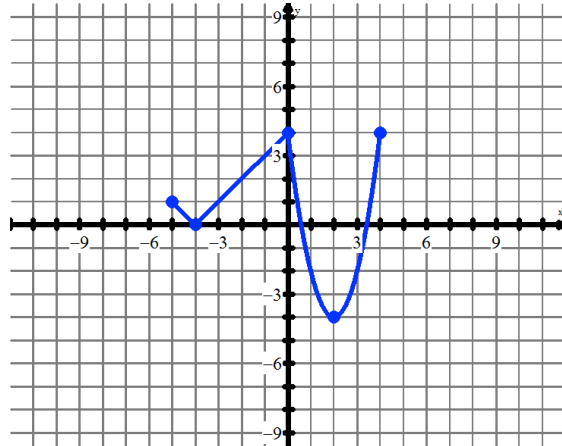
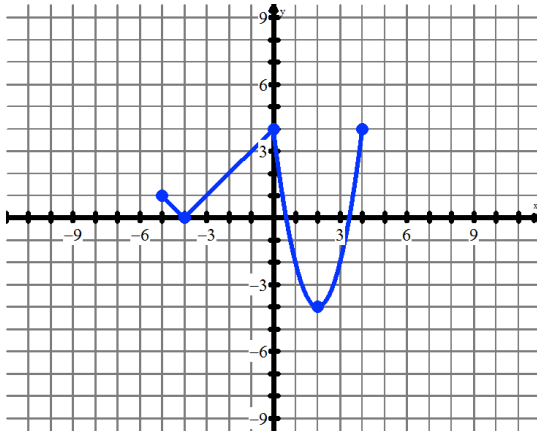
13. Given the polynomial $Q(x) = x^3 + 11x^2 - x^4 - 9x - 18$, answer the following questions. Show/explain the thinking or working that leads to your answers.

(5 marks)

- Is $x - 1$ a factor of this polynomial? (2)
- Is 3 a zero of this polynomial? (2)
- What is the end behaviour of this polynomial? (1)

14. You have been provided with a graph of a piecewise function, $y = f(x)$, which is pictured below. **(8 marks)**

- On Graph 1, graph the inverse of this function.
- Given the NEW equation of $y = \frac{1}{2}f(x+1) - 3$, list what transformations will be applied to $y = f(x)$
- Now apply the transformations to $y = f(x)$ and sketch the new transformed function on the second graph. Show all necessary work to support your sketch of the new function.



15. In this question, you will work with the quadratic function $f(x) = -\frac{1}{4}(x+2)(x-6)$. **(14 marks)**

- | | |
|--|---|
| (a) Where are the zeroes of this function? (1) | (b) Where is the y-intercept? (1) |
| (c) Write the equation in vertex form. (3) | (d) Write the equation in standard form. (1) |
| (e) This function represents a transformed parabola. List the transformations that were applied to the parent function, $y = x^2$. (2) | (f) Graph the INVERSE RELATION (including the exact location of its vertex and intercepts). (3) |
| (g) The graph of the inverse relation you just drew is NOT a function. By making certain domain/range restrictions, we can make this RELATION into a function. Explain one restriction that can be made to create a FUNCTION from this RELATION. (1) | (g) Find the equation of the inverse function. (2) |

16. The function $g(x) = 3\sin\left(\frac{1}{2}x\right) - 5$ starts at $x = 0$ and **complete 2 cycles**, determine the period & amplitude & equation of the axis of the curve and the domain and range. **(5 marks)**

- | | | |
|-------------|----------------|------------------------|
| a. Period = | b. Amplitude = | c. Axis of the curve = |
| d. Domain = | e. Range = | |

17. The following questions deal with analyzing an equation of a quadratic function in order to answer questions about the quadratic function & its features. Use any algebraic strategy in your solutions. **(8 marks)**

a. Given the parabola $y = -\frac{3}{2}x^2 + 9x - 12$. Write down the EQUATION of the axis of symmetry (1)

c. Determine the x-intercepts of the quadratic function $f(x) = 5x^2 - 13x + 6$ (2)

b. Determine the coordinates of the vertex of.

$$y = -\frac{3}{2}x^2 + 9x - 12 \quad (2)$$

d. Write the quadratic equation $f(x) = 3(x - 5)^2 + 6$ in standard form. (2)

e. Does the parabola $f(x) = 3(x - 5)^2 + 6$ have any x-intercepts? How do you know? (1)

18. The following questions will focus on your understanding with the new concept of “angles in standard position”, as you work with an angle of -140° . **(7 marks)**

a. Sketch a diagram of a -140° angle when drawn in standard position.

b. Show the **principal angle** on your diagram and state its measure.

c. Show the **related acute angle** (or **reference angle**) on your diagram and state its measure.

d. State the measure of **two** angles that are **co-terminal** to this -140° angle.

e. Mr. S would like to know if the **tangent ratio** of this -140° angle is positive or negative. Explain to Mr. S which it is (positive or negative) and explain WHY you know the sign of the ratio.

19. You will produce a sketch of a function that meets the following requirements: **(5 marks)**

- The domain is to be $\{x \in R \mid x < 4\}$.
- The function is to be increasing ONLY on the interval of $\{x \in R \mid -2 < x < 2\}$.

- The absolute minimum point must be at $(-2, -9)$.
- The function must have an asymptote.

a. Label your KEY POINTS.

b. Explain why the range of your function is $\{y \in R \mid y \geq -9\}$.

c. EXPLAIN what you would have to do with your KEY POINTS in order to graph the new function $y = f(x - 2) + 4$.

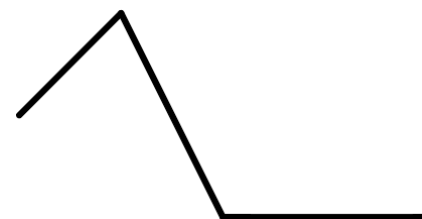
d. Is inverse of your function also a function? Explain why or why not.

20. Given the rational function $f(x) = \frac{-3x+6}{2x-3}$, determine:

(6 marks)

- a. the equations of the vertical and horizontal asymptotes. (2)
- b. the domain and range of $f(x)$ (2)
- c. the x- and y-intercepts of $f(x)$ (2)

21. Draw 2 cycles of a graph of the given periodic function (see diagram) whose period is 30, the amplitude is 10 and whose axis of the curve is $y = 20$. Make sure that your sketch is properly scaled along the x- and y-axis. The cyclical pattern (i.e. the parent function) is shown at the right →



(4 marks)



22. Knowing that $x = -4$ is an x-intercept of the cubic function $p(x) = 2x^3 + 11x^2 + 10x - 8$, fully factor the polynomial. Once factored, state the values of the zeroes of $p(x)$.

(7 marks)

23. Answer the following questions that each deal with basic concepts from Unit 5.

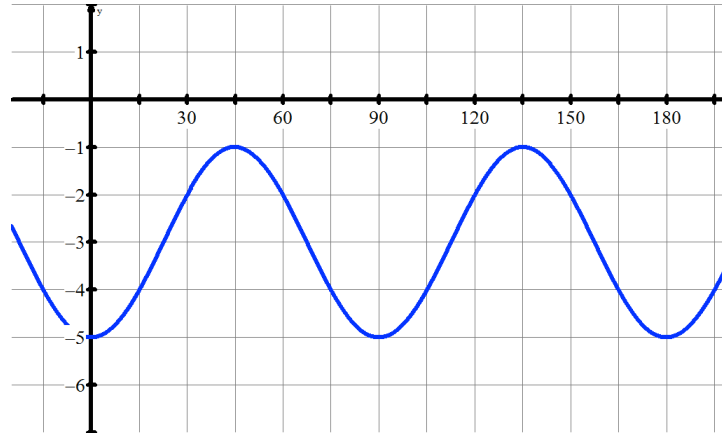
- a. Show whether or not $2x - 1$ is a factor of $p(x) = 4x^4 - 2x^3 - 2x^2 + 13x - 6$
- b. State the end behaviours of $f(x) = \frac{2x-5}{6x-9}$
- c. Determine the quotient when $x^4 - 6x^2 + 4x - 3$ is divided by $x + 3$
- d. Determine the leading coefficient of $y = -2(4-x)(3x-2)^2$

24. A parabola has x-intercepts at $x = 3$ and $x = -7$ and goes through the point $(-5, 8)$.

(6 marks)

- a. Provide a sketch of the parabola, given the details provided. (3)
- b. Write the equation of this parabola in vertex form, showing the key steps in your solution. (3)

25. Here is a graph of a transformed sine function. Use this graph to state the amplitude, period, axis of the curve and then write the equation of this sinusoidal function (use sine OR cosine as you wish). **(5 marks)**



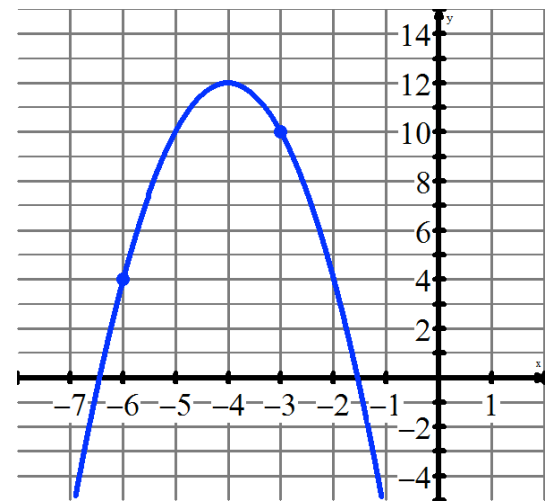
26. From the diagram of the parabola:

- a. Determine its equation in vertex form. Show the key steps of your solution.

(4 marks)

- b. Describe the transformations applied to the parent function ($y = x^2$) to create the graph above.

(3 marks)



27. Given the rational function $r(x) = \frac{4}{x-5} + 3$, answer the following analysis questions:

- a. State the equations of the asymptotes of $r(x)$.

- b. State the domain and range of $r(x)$.

The parent function, $y = \frac{1}{x}$, had two key points, one at (1,1) and the other at (-1,-1).

- c. List the transformations that have been applied to the parent function $y = \frac{1}{x}$.

- d. Determine where these two key points are now located, given the transformations that have been applied.

- e. Sketch the function $r(x) = \frac{4}{x-5} + 3$. On your sketch, label the asymptotes and the new key points.

28. Draw 2 cycles of a graph of $f(x) = 3\sin(x - 60) - 2 \rightarrow$

(5 marks)

29. In order to effectively use the TI-84 graphing calculator when analyzing sinusoidal functions & periodic phenomenon, you must be able to set appropriate window settings to view the functions. State what window settings you should use to see **four periods** of the function $f(x) = 12\cos(3x) - 15$ and show/explain your reasoning for these window settings. **(3 marks)**

30. The cubic polynomial equation $g(x) = 2x^3 + x^2 - 13x + 6$ is presented in standard form.

- You are required to factor it using synthetic division and then write the equation now in factored form.
- Now that the equation has been factored, present a sketch of the cubic function. Label the zeroes.

31. You are given a graph of the polynomial function below. Use the graph to **estimate** and thus answer the following:

- What are the linear factors of this polynomial?
- Predict the remainder when the polynomial is divided by $x - 4$. Explain how you determined your answer.

