 **Methods 11 Investigation 1 2018**

**Trigonometry**

**Total Marks: 56 Time Allowed: 60 minutes**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Take home section and Classpad allowed**

**ALL** working must be shown for full marks.

**1.** **[3, 2, 1, 1, 2, 1, 1, 1, 1 = 13 marks]**

Using your knowledge of unit circle, complete the following chart for f(x) = sin x.

**Use exact values. DO NOT ANSWER IN DECIMALS!!!!**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| sinx |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

a) What do you notice about the values in the chart?

b) For which values of x does sinx = 1? (There is more than one answer)

c) For which values of x does sinx = -1?

d) For which values of x does sinx = 0?

e) What is the domain and range for the table above?

f) Describe the pattern of when sinx is a maximum?

g) Describe the pattern of when the x-intercepts occur?

h) If the domain has no restrictions, find the value(s) of.

**2.** **[2, 1, 1, 1, 1, 1, 1, 2 = 10 marks]**

Using your knowledge of unit circle, complete the following chart for f(x) = cosx. **(Use exact values.)**

**DO NOT ANSWER IN DECIMALS!!!!**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x |  |  |  |  |  |  |  |  | 0 |  |  |  |  |  |  |  |  |
| cosx |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

a) For which value(s) of x is cos x = 1?

b) For which value(s) of x is cos x = 0?

c) What is the domain and range for the table above?

d) Describe the pattern of when cos x is a maximum.

e) Describe the pattern of when the x-intercepts occur.

f) If the domain is infinite, find the value of

g) Find all values of x, such that cos x =

Consider the functions f(x) = a sin (b(x + h)) + v and g(x) = a cos (b(x + h)) + v.

a, b, h, and v have specific effects on the graphs of the function. In trigonometry we also have special names for the pronumerals based on their effect on the graph.

**3. [2, 2 = 7 marks]**

a) The **amplitude** of the function is “a”. How is the amplitude related to the distance between the minimum and maximum values? (Hint: change the “a” value for each function to determine the effect of “a” on the distance between the minimum and maximum values.)

b) What effect does “a” have if a < 0?

**4. [2, 1, 1, 2 = 6 marks]**

a) The **period** of the function is “b”. Describe the effect of changing the “b” value.

b) When “b” is 2, how often does the function repeat itself in the usual period of 2?

c) When “b” is 4, how often does the function repeat itself in the usual period of 2π?

d) Define the period of the sin and cosine functions in terms of “b” and 2π.

**5. [1, 1, 2, 1 = 5 marks]**

A horizontal translation of a trigonometric function is called a **phase shift**. The “h” value shifts the graph horizontally, however, when calculating the phase shift you have to also consider the value of “b”. The phase shift = .

a) Graph f(x) = sin x and g(x) = sin (x + 90) using degrees. For what values of x is f(x) = 0?

b) For what values is g(x) = 0?

c) What do you notice about your answers?

d) Determine the value of ”h” which will ensure sin(x + h) = cos x.

Give your answer in both degrees and radians.

**6. [2, 2 = 4 marks]**

Complete the following table.

|  |  |  |
| --- | --- | --- |
| **Function** | **Period** | **Amplitude** |
|  |  |  |
|  |  |  |

**7. [2, 1, 2 = 5 marks]**

The following equation models the average monthly temperatures for Hobart. (The average monthly temperature is an average of the daily highs and daily lows.)

where t = represents January.

a) State the values of a, k, b, v in the equation.

b) The maximum and minimum values of a periodic function oscillate about a horizontal line called the **midline.** What is the midline of the equation?

c) How is the value of the amplitude related to this midline?

**8.** **[2, 4 = 6 marks]**

Steven gets on a Ferris wheel at the Royal Show. His height, h metres, t seconds after the ride starts is given in the table below.

**Instructions on calculator use to help with this question.**

* Open the Statistics application
* Enter the data (t into list 1, h into list 2)
* Tap on graph icon to draw a scatter graph
* Select [Calc| Regression| Sinusoidal Reg]
* Save the function to y1 so you can work with the function in the Graph & Table application.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| t(s) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| h(m) | 1 | 1.13 | 1.52 | 2.15 | 2.99 | 4 | 5.15 | 6.38 | 7.63 | 8.85 | 10 |

a) Write down the equation with rounding to whole numbers.

b) Use your model to determine the:

i) radius of the Ferris wheel

ii) minimum and maximum height of Tan above the ground

iii) time taken for one complete revolution.