Paper 1 - CALCULATOR INACTIVE

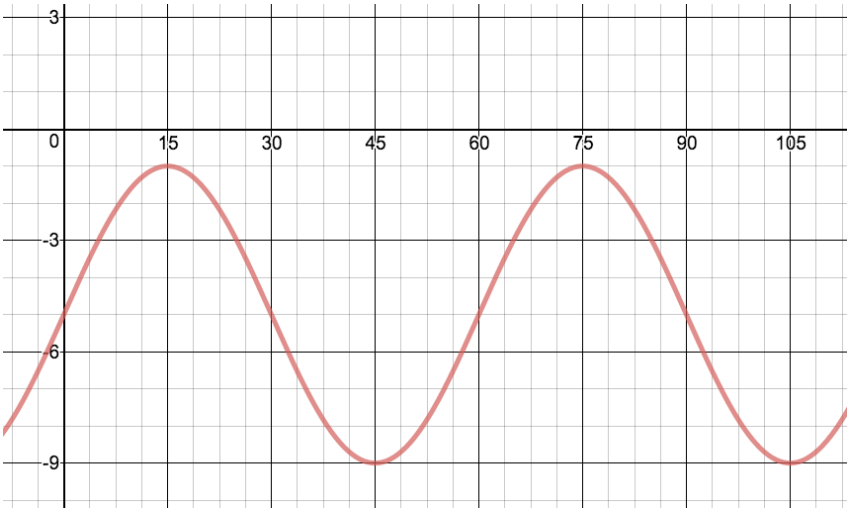
Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written work. You are advised to show all working.

SECTION A

Answer all questions in the spaces provided.

1. The graph of the function $y = A\sin(kx) + D$ is given below.

(7 marks)



a. Determine the values of A, k, and D and hence, write the equation of this function.

(3)

b. List the transformations that were applied to the parent function $y = \sin(x)$.

(2)

c. This function could also be written using a cosine function. Determine an equation for this function using cosine rather than sine.

(1)

2. In this question, you will work with a our special right triangles.

(7 marks)

a. Draw and correctly label the angles and sides of the 30 – 60 – 90 triangle. (1)

b. You will now use the special triangles to evaluate two trigonometric expressions:

i. Evaluate $2(\cos 30°)^2 - 1$.

(2)

ii. State the value of $\cos(60°)$

(1)

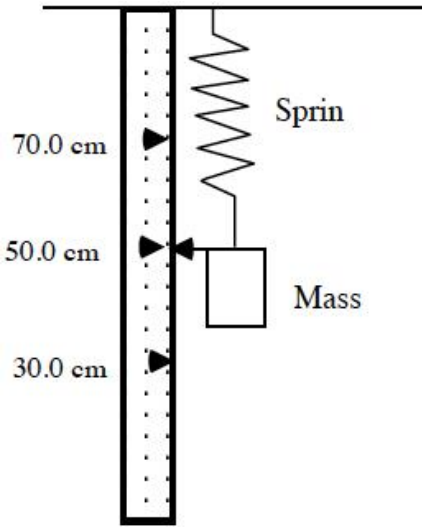
iii. What conclusion could you make about the equation $\cos(2x) = 2(\cos x)^2 - 1$? Explain your reasoning.

(1)

c. Solve the equation $\tan(x) = \frac{1}{\sqrt{3}}$ on the domain of $-360° \le x \le 360°$.

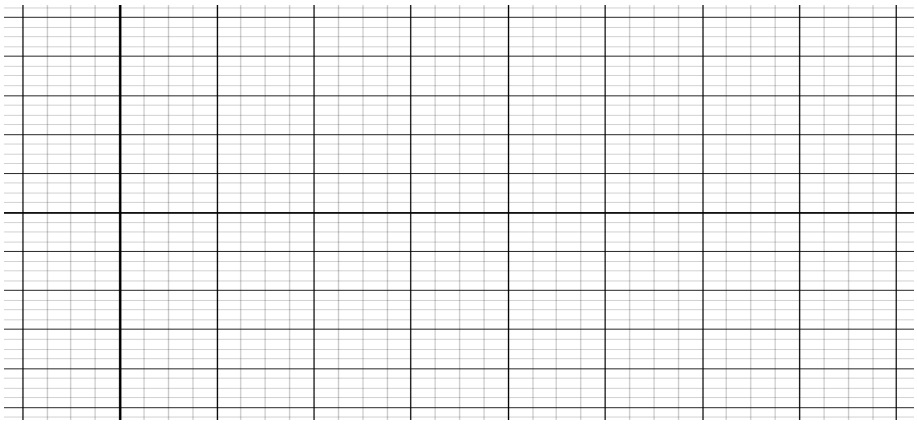
(2)

3. Mr D is performing an experiment, wherein he is investigating the motion of a vertical oscillator (see diagram included). A data table is included from his experiment, where h is the height above the ground, measured in centimeters, and t is time in seconds



Time (sec)	0	2.25	4.5	6.75	9	11.25	13.5
Height (cm)	30	50	70	50	30	50	70

a. Graph the data on the grid provided. (2)



b. Determine an equation for the oscillating motion of the mass in the form of $h(t) = A\cos(kt) + D$, where h is height above the ground, measured in centimeters, and t is time in seconds.

(3)

Mr S now wonders if the **increasing the weight of the mass** affects the period of the oscillation. He repeats the experiment with a heavier weight and wishes to model the height-time relationship of his new set up for the oscillator.

c. If the oscillator now takes **MORE time** to complete a complete cycle, write a NEW equation in the form of $h(t) = P\cos(Qt) + R$, explaining your reasoning for the values for P, Q and R (HINT: which may or may not change???)

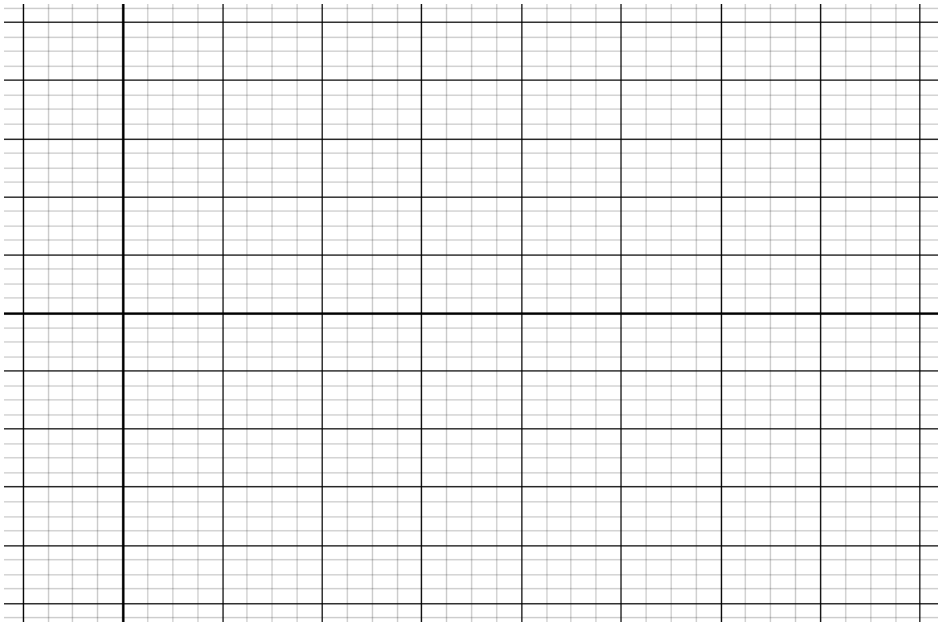
(2)

4. Given the function $f(x) = 3\cos(9x) + 5$, determine the:

(7 marks)

a. Graph two cycles, labelling each maximum and minimum points in these two cycles.

(3)



b. Explain how would you use your graph to find the value of $f(1240)$. What is the value of $f(1240)$?

(2)

c. Mr S is trying to solve the equation $2 = 3\cos(9x) + 5$ and he suggests that $x = 430°$ is one answer. Explain how you would use your graph to decide whether or not Mr S is correct.

(2)

Paper 2 – CALCULATOR ACTIVE

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

Answer all questions in the spaces provided.

1. The function $J(t) = 5.25\sin(6.92t) + 7.8$ is used to model the number of weekly job applications **(in hundreds)** for the GOGEL MATH Company, where t is the time **in weeks from Jun 1st, 2014 until today's date (late May of 2017)**.

(6 marks)

a. Interpret the meaning of $J(29) = 5.95$.

(2)

b. State a domain for this function. Explain your reasoning.

(2)

c. Since June 1st, 2016, for what values of t have there been **at most** 1000 weekly job applications?

(2)

2. In ΔABC, side AB is 17 cm, side AC is 20 cm and ∠BAC = 70°.

(6 marks)

a. Prepare a sketch of this triangle and correctly label the given information in your diagram.

(1)

b. Find the **perimeter** of this triangle.

(3)

c. Determine the area of ΔABC.

(2)

3. An angle, θ, is drawn in standard position and its terminal arm goes through the point A(4,-6).

(8 marks)

a. Draw a diagram of this angle θ and show the principal angle and the related acute angle.

(3)

b. Explain **why** the value of the cosine ratio of this angle is: $\cos(\theta) = -\frac{6}{\sqrt{52}}$.

(2)

c. Determine the value of the principal angle of θ, to the nearest degree.

(1)

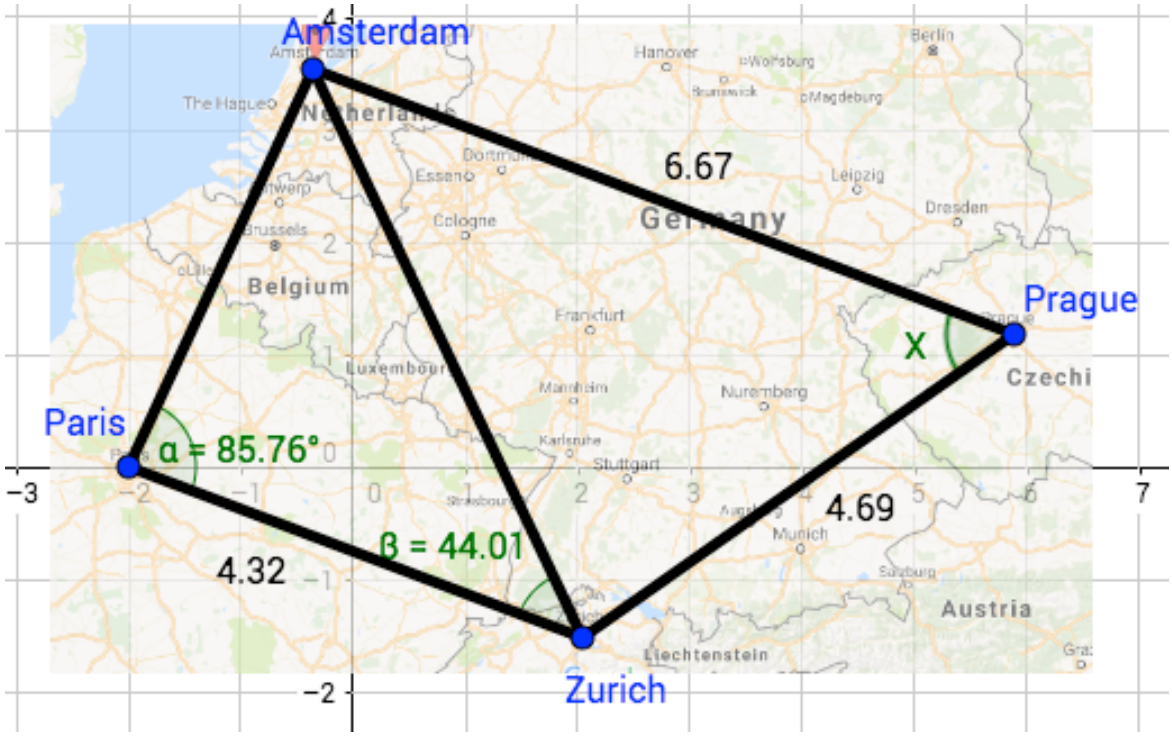
d. State the measures of two other angles whose terminal arms would also go through the point A(4,-6). Explain/show your thinking.

(2)

SECTION B

Do NOT write solutions on this page. Answer all questions on the answer sheets provided.

1. Mr. S and Mr. D are vacationing in Europe this summer and need to know some information to help with their travel plans. We used GEOGEBRA to help us work out distances, so here is a diagram showing the cities of Amsterdam, Prague, Paris and Zurich. Major flight paths are shown between the cities and shown in the form of 2 triangles below.



a. To solve for the required angle (at Prague - labelled as x in the diagram):

(6)

i. In ΔAZPa to find side AZ

ii. Then, in ΔAZPr, find the measure of ∠Pr (the angle at Prague, marked as X in the diagram)

b. To help you find the direct distance from Prague to Paris,

(6)

i. Show that the **entire** angle at Amsterdam (∠PaAPr) is 94.1°.

ii. Hence, or otherwise, find the distance between Paris and Prague.

2. Mr. S and Mr. D are vacationing in the city of Prague (Czech Republic). The number of hours (and minutes) of daylight on the 15th of each month, beginning in January, is shown for Prague.

(11 marks)

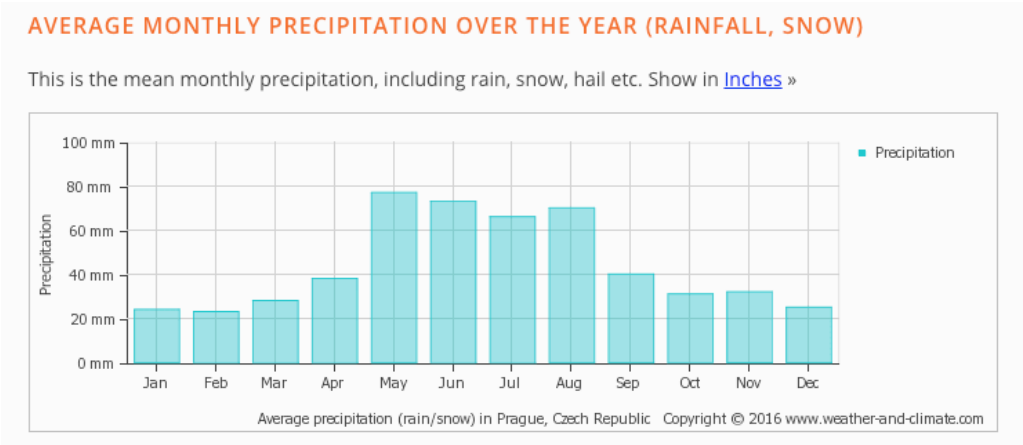
Month	Hours of Daylight
1	8:30
2	10:07
3	11:48
4	13:44
5	15:04
6	16:21
7	15:38
8	14:33
9	12:42
10	10:47
11	9:06
12	8:05

a. Explain why Mr S changes the time of 8:30 hours into 8.5 hours. (1)

b. Use your curve of best fit and the data table to write a model for the number of hours of daylight as a function of the month (where m = 1 represents January). (3)

c. Use your **model** to predict the number of hours of daylight on July 31st. (2)

Likewise, the following bar graph gives us data for the amount of rainfall in Prague.



Mr. S will use $R(m) = 27\sin(30(m-4)) + 50$ to model the amount of rainfall in Prague.

d. To help justify that the model is **appropriate**, explain why the parameters of A = 27 and D = 50 are **appropriate and correct** in this model. (2)

e. To help justify that Mr. S's model is **inappropriate**, use your model to predict how much rain we could expect in Prague in May (month 5). State the value for the rainfall from the chart for the month of May. (2)

f. Finally, is Mr. S's model appropriate? Justify your answer. (1)

Scatterplot for Question #2(a)