école européenne de strasbourg	**Date**	**21/06/2022**
	Class	**S6EN**
	Subject	**MATHEMATICS** **3-Period** PART B
	Duration	**90 Minutes**
	Teacher	**D. Shaw**

NAME :		
Marks	***Comments***	***Signature***
/65		

Exam WITH calculator

Instructions

- *This exam consists of 6 questions on 6 pages including this cover page.*
- *All questions are compulsory.*
- *Answer on squared paper (provided) and submit the question paper with your answers.*
- Any attempt at cheating will result in the immediate cancellation of your exam.
- Read all the questions calmly and thoroughly and show all workings clearly.

Good luck!

Question 1: [7 Marks]

Consider a rapid test to determine infection with a certain disease. We know that someone who has the disease will be correctly diagnosed 96% of the time. Someone who does not have the disease will be falsely diagnosed, a false positive, 2% of the time.

The disease is prevalent in 0.4% of the population.

a) A patient takes a test. Calculate the probability that they will get a positive result. /3

b) The test result comes back positive. Calculate the probability that the patient has the disease given that they got a positive result. /4

<u>Question 2:</u> [7 Marks]

When you play roulette at a casino, we can bet on one of the 37 numbers from 0 to 36. Alternatively you can bet on the colour red or black (0 is coloured green). For the remainder of the question, consider a bet of €100. a) If you bet on red and the ball falls on one of the 18 red compartments, your money is doubled. Calculate the Expected value of the random variable X : « amount won betting on red ». b) Compare this value with the Expected value of the random variable Y : « Amount won betting on a specific number ». If the ball stops in the compartment you have bet on, you receive 36 times what you bet.	/3 /4

Question 3: [11 Marks]

From a group of 10 runners and 15 non-runners, a university researcher selects 5 people for a study on cardio-vascular disease.	
a) How many groups is it possible to make if we make no distinction between the runners and the non-runners?	/3
b) How many groups is it possible to make if we want exactly three runners participating in the study?	/4
c) What is the probability that, given a random selection of participants in the study, that there would be exactly three runners in the group?	/4

Question 4: [14 Marks]

Consider the function f defined by $f(x) = -\frac{x^3}{3} - \frac{x^2}{2} + 6x + 4$.	
1) Determine an expression for f', the derivative of the function f.	/4
2) Study the sign of f' (make a sign table).	/6
3) Determine the interval in which the function f is increasing.	/4

Question 5: [16 Marks]

The function, $f(x) = 60Cos\left(\frac{2\pi}{30}(t-15)\right) + 75$ can be used to model the height of a passenger above the ground on the London Eye, where t is the time in minutes after departure.

a) Determine the period of the London Eye. /2

b) Determine the amplitude of the London Eye. /3

c) Use this function to estimate the height of a passenger 18 minutes after departure. /2

d) What height above the ground is the boarding platform? /3

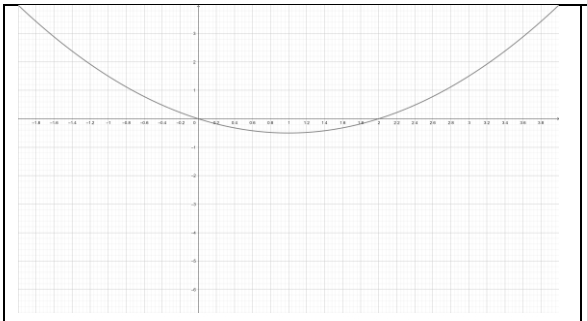
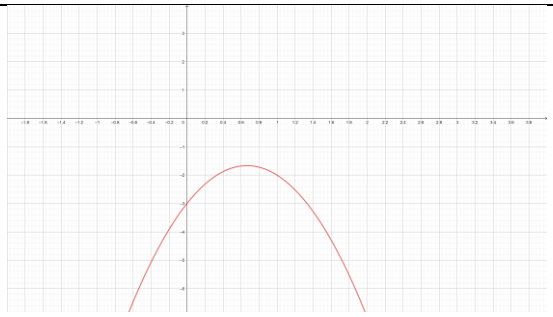
e) Sketch the graph of the function $f(x)$. /3

f) Use your graph to estimate how long a passenger would spend more than 100m above the ground. /3

Question 6: [10 Marks]

Below are three functions labelled A, B, C, D and E and their derivatives labelled I, II, III, IV and V. Match each function to its corresponding derivative.

/10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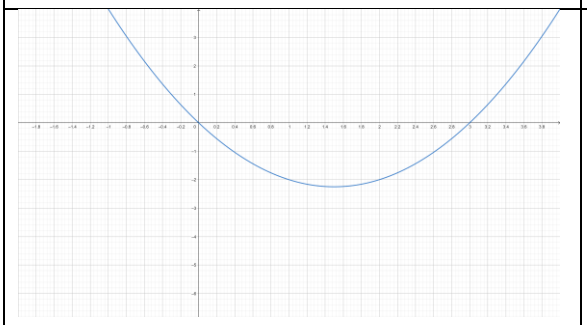	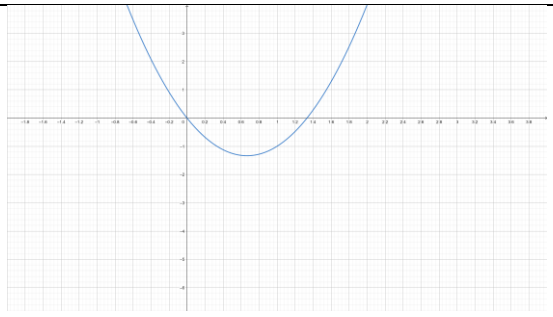
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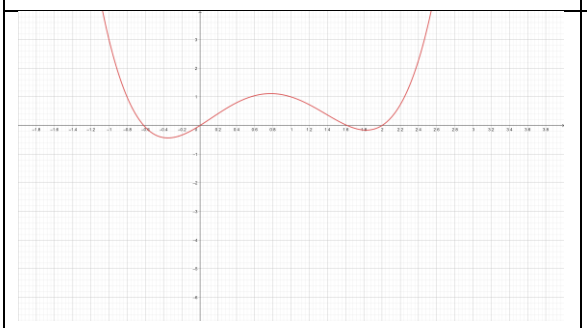	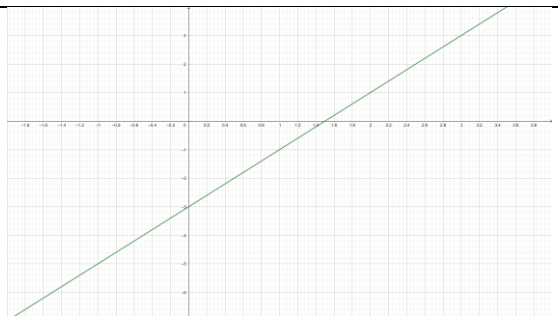
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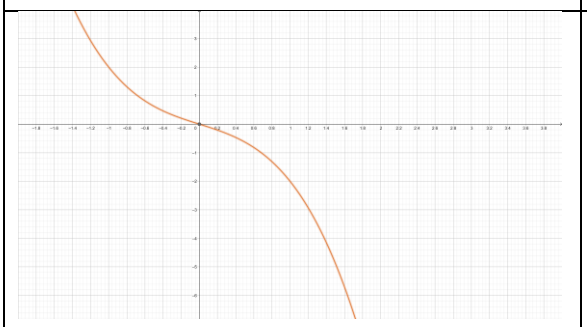	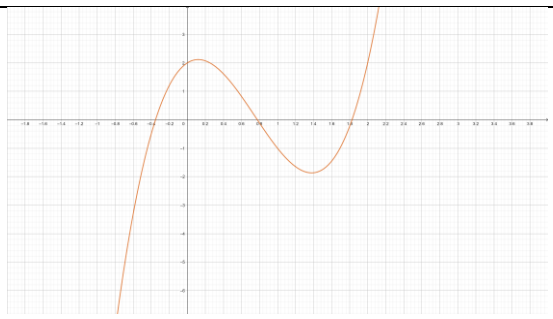
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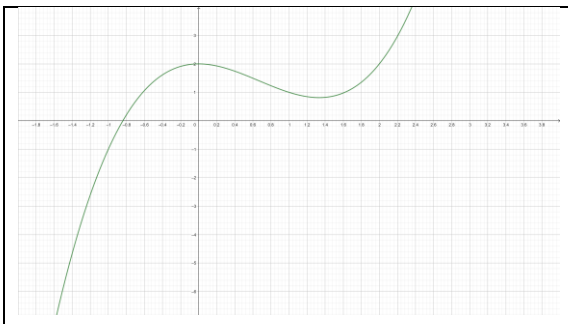	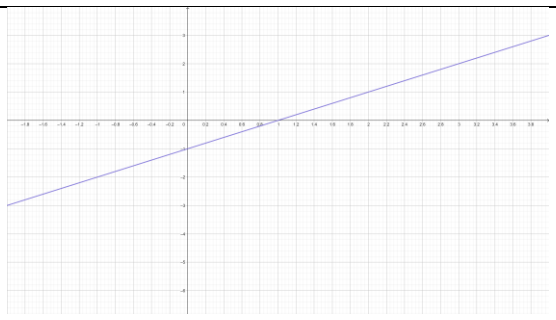
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