CORK INSTITUTE OF TECHNOLOGY
INSTITIÚID TEICNEOLAÍOCHTA CHORCAÍ

Autumn Examinations 2017/18

Module Title: Maths for the Green Industry

Module Code: MATH6052

School: Business

Programme Title(s): Batchelor of Science in Agriculture
Batchelor of Science in Horticulture

Programmes Code(s): BAGRI_7_Y1
BHORT_7_Y1

External Examiner(s): Dr James Cruickshank

Internal Examiner(s): Katie Bullen

Instructions: **Answer Question 1 – Compulsory (40 marks) and THREE other questions (20 marks each).**
Do not write, draw or underline in RED.
Show all calculations and workings in full.

Duration: 2 HOURS

Sitting: Autumn 2018

Requirements for this examination: Candidates may request a copy of the State Examinations Commission's formulae and tables booklet.

Note to Candidates: Please check the Programme Title and the Module Title to ensure that you have received the correct examination. If in doubt please contact an Invigilator.

Question 1. COMPULSORY

Answer **all** questions

(a) Evaluate the following expression, without the use of a calculator, express your answer in its simplest form **[5 marks]**

$$\frac{3\frac{2}{3}+\frac{1}{4}}{2\frac{5}{6}-\frac{13}{6}}$$

(b) If the selling price of an item is €256.50, calculate the cost price if the item is being sold at a profit of 14%? **[4 marks]**

(c) If 12 people can complete a task in 3 hours, how long would it take 15 people to complete the same task, assuming that the work rate remained constant? Give your answer in hours and minutes. **[4 marks]**

(d) By rounding each number correct to one significant figure, estimate the answer to the expression below and calculate the percentage error in this estimate. **[6 marks]**

$$\frac{0.00482+0.01895}{0.0355-0.00942}$$

(e) Convert 25 miles per hour into metres per second if 1 mile = 1609 m. **[4 marks]**

(f) Simplify the following expression, give your answer in positive indices only:

$$\frac{a^6b^3c^{-2}}{a^2b^5c^2}$$

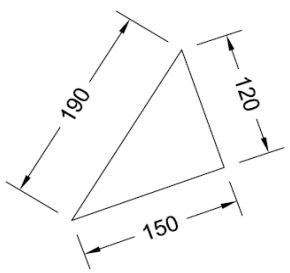
[4 marks]

(g) The table below shows the level of cheese production in Ireland from the years 2012 to 2016 inclusive. Calculate the fixed base index numbers for this data, using 2012 as the base year, give your answers to the nearest whole number. **[5 marks]**

Year	2012	2013	2014	2015	2016
Cheese production (tonnes)	186	183	188	207	205

(h) A saver deposits €1245 into an account that earns an annual interest rate of 1.5%. Assuming that interest is compounded annually, calculate the final amount after 8 years. Give your answer to the nearest cent. **[4 marks]**

(i) Determine if the triangle shown in the diagram is right-angled. Show all your workings. **[4 marks]**



Question 2.

(a) Make p the subject of the formula:

$$n = \sqrt{\frac{m - 2p}{2m + p}}$$

[7 marks]

(b) Solve the simultaneous equations:

$$2x + y + z = 8$$

$$5x - 3y + 2z = 3$$

$$7x - 3y + 3z = 20$$

[7 marks]

(c) Frances earns €58,000 in a year. Her standard rate cut off point is €34,550 and tax credits are €3,520 for the year. The standard rate of tax is 20% and the higher rate is 40%. She pays PRSI at a rate of 4% on all her income and also pays USC at a rate of 0.5% on the first €12,012, at 2% on the next €7,360 and 4.75% on her income above this.

(i) How much PAYE does Frances pay from her salary?

(ii) Calculate Frances' net pay.

[6 marks]

Question 3.

(a) If A(2,-2) and B(4,4) are two points.

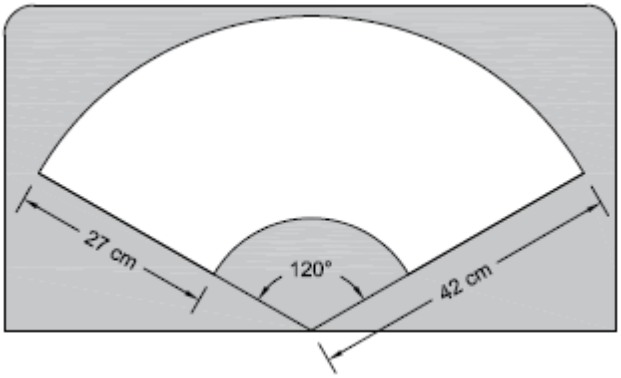
(i) Draw a graph of the line segment [AB]

(ii) Find the equation of the line that passes through the points A and B

(iii) Use your equation to calculate the coordinates of the points where the line crosses the x axis and the y axis.

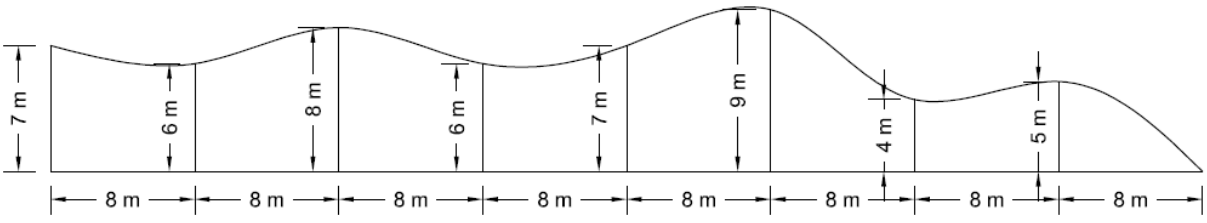
[8 marks]

(b) The rear windscreen wiper of a car rotates on an arm 42 cm long. The wiper blade is 27 cm long. The wiper rotates through an angle of 120^{o}, as shown in the diagram. Calculate the area of the windscreen that is cleaned by the wiper, give your answer to the nearest whole number. **[6 marks]**



(c) Use Simpson's Rule to find the area of a strip of land with measurements as follows:

Horizontal distance (m)	0	8	16	24	32	40	48	56	64
Vertical distance (m)	7	6	8	6	7	9	4	5	0

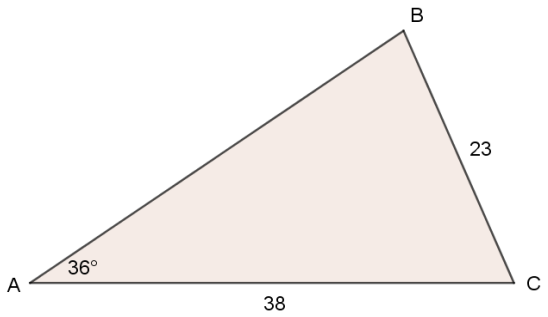


[**6 marks]**

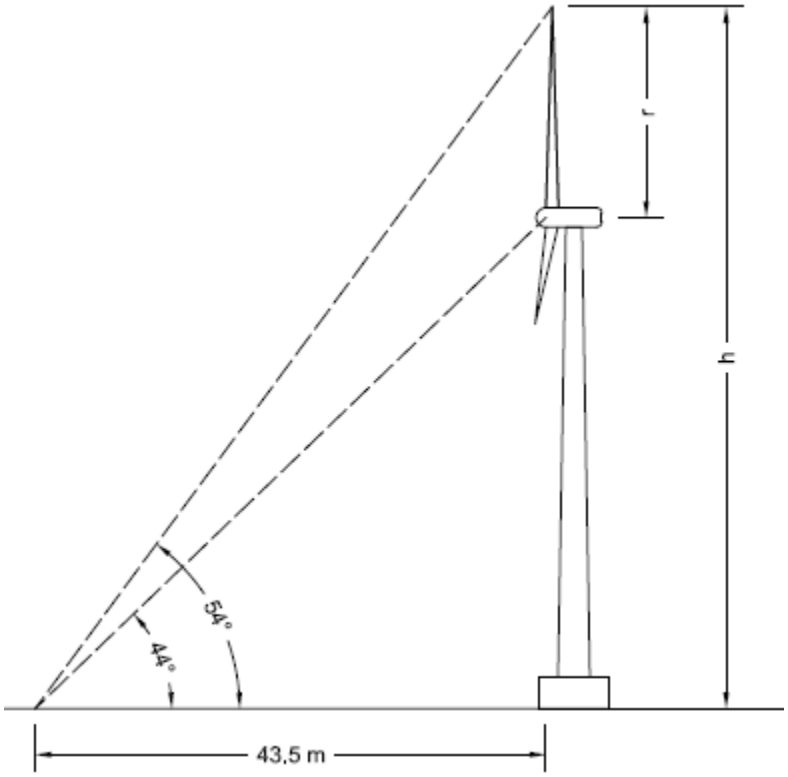
Question 4.

(a) Given an acute triangle ABC, calculate $|< ABC|$ given that $|< BAC| = 36°$, $|AC| = 38$ and $|BC| = 23$.

[6 marks]



(b) A wind farm is to be located in a rural upland area, from a point 43.5 m back from the centre of the turbine, the angle of elevation to the hub is 44° and the angle to elevation to the tip of the blade when it's at its highest point is 54°.



(i) Calculate the total height, h of the wind turbine. Give your answer to the nearest metre.

(ii) Calculate the length, r of one of the blades.

(iii) Using the length of the blade, calculate the circumference of the circle traced out by the tip of the blade.

(iv) If the tips of the blades move at a speed of 28 m/s, how long does a single blade take to go through one full revolution?

[14 marks]

Question 5.

The table below summarises the heights of trees in a copse.

Height (metres)	Number of trees
0 but less than 5	11
5 but less than 10	17
10 but less than 15	25
15 but less than 20	28
20 but less than 25	14
25 but less than 30	5

(a) Construct a cumulative frequency table for this distribution

(b) Sketch, on graph paper, the ogive (cumulative frequency curve) for this set of data.

(c) Using your ogive estimate the median tree height.

(d) Using your ogive estimate the interquartile range of the data.

(e) Estimate the percentage of trees over 18 m in height.

(f) Using your calculator and the table above, calculate the mean height of the trees.

(g) Using your calculator and the table above, calculate the standard deviation from the mean.

[20 marks]