



PRE-LEAVING CERTIFICATE EXAMINATION, 2012

MARKING SCHEME

PROJECT MATHS

HIGHER LEVEL

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OVERVIEW OF MARKING SCHEME

Scale label	A	B	C	D	E
No of categories	2	3	4	5	6
5 mark scale	0, 5	0, 3, 5	0, 3, 4, 5		
10 mark scale	0, 10	0, 6, 10	0, 5, 8, 10	0, 2, 5, 8, 10	
15 mark scale	0, 15	0, 8, 15	0, 8, 13, 15	0, 7, 10, 13, 15	
20 mark scale	0, 20	0, 10, 20	0, 10, 18, 20	0, 5, 10, 15, 20	
25 mark scale		0, 12, 25	0, 8, 20, 25	0, 6, 12, 19, 25	0, 5, 10, 15, 20, 25

A general descriptor of each point on each scale is given below. More specific directions in relation to interpreting the scales in the context of each question are given in the body of the scheme, where necessary.

Marking scales – level descriptors

A-scales (two categories)

- incorrect response (no credit)
- correct response (full credit)

B-scales (three categories)

- response of no substantial merit (no credit)
- partially correct response (partial credit)
- correct response (full credit)

C-scales (four categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

D-scales (five categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- response about half-right (middle partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

E-scales (six categories)

- response of no substantial merit (no credit)
- response with some merit (low partial credit)
- response about half-right (lower middle partial credit)
- response more than half-right (upper middle partial credit)
- almost correct response (high partial credit)
- correct response (full credit)

SOLUTIONS TO PAPER 1

All questions marking category are shown throughout the solutions.

Question 1

Part (a)

Scale 10C

Part (b)

Scale 15C

(a) If $p(2 - 4i) - q(-5 - 3i) = 3(12 + 2i)$ find the value of $p, q \in Z$.

$$p(2 - 4i) - q(-5 - 3i) = 3(12 + 2i)$$

$$2p - 4pi + 5q + 3qi = 36 + 6i$$

$$2p + 5q = 36$$

$$-4p + 3q = 6$$

$$\therefore p = 3, q = 6$$

Full Credit
(10 Marks)

- Fully correct solution

High Partial Credit
(8 Marks)

- Solves one variable correctly
- Solves both variable with no more than two minor errors

Low Partial Credit
(5 Marks)

- Solves both variable with more than two minor errors
- Some correct step

(b) Express $z = -1 + \sqrt{3}i$ in polar form and hence find the value of z^7 in rectangular form.

$$z = 2(\cos(120) + i \sin(120))$$

$$z^7 = 2^7 \cos(120) + i \sin(120)^7$$

$$z^7 = 2^7 \cos(840) + i \sin(840)$$

$$z^7 = -64 + 64\sqrt{3}i$$

Full Credit
(15 Marks)

- Fully correct solution

High Partial Credit
(13 Marks)

- One error in converting to polar form and continues correctly
- Fails to convert to rectangular form

Low Partial Credit
(8 Marks)

- More the one error in converting to polar form and continues correctly
- Some correct step including correct diagram with z plotted

Question 2

Part (a)	Scale 5B
Part (b)	Scale 5A
Part (c)	Scale 5B
Part (d)	Scale 10C

- (a) If $S_1 = 2$ and $S_3 = 12$ for an arithmetic sequence find the value of a , the first term of the sequence and d , the common difference.

$$a = 2, d = 2$$

Full Credit (5 Marks)

- Fully correct solution with or without workings

Partial Credit (3 Marks)

- Only a or d correct
- Any correct substitution into a relevant formula.

- (b) Prove that the sum of the first n even numbers is $n^2 + n$

PROOF

Full Credit (5 Marks)

- Fully correct solution with work shown

- (c) Find the sum of the even number from 101 to 200 inclusive.

$$S_{100} = 100^2 + 100 = 10100$$

$$S_{200} = 200^2 + 200 = 40200$$

$$S_{200} - S_{100} = 30100$$

Step 1: Prove for $n = 1$

Step 2: Assume true for $n = k$

Step 3: Prove for $n = k + 1$

Full Credit (10 Marks)

- Fully correct solution

Partial Credit (8 Marks)

- Omits one step
- Solution contains all steps but final conclusion not reached

Low Partial Credit (5 Marks)

- Some correct step

Question 3

Part (a)

Scale 10B

Part (b)

Scale 15C

The function $f : x \rightarrow x^3 + ax^2 + bx + c$ crosses the x axis at $x = -1$ and $x = 4$ where a, b and $c \in \mathbb{Z}$

(a) Give three possible values for c , explaining your choices fully.

Any multiples of (-4) , c will always be (-4) (the constant in the other factor)

**Full Credit
(10 Marks)**

- **Fully correct solution**

**Partial Credit
(6 Marks)**

- **All three values not correct or incorrect conclusion**

(b) The general term of a sequence is given by $T_n = ax^2 + bx + c$ If the first four terms are 1, 10, 23, 40 find the values of a, b and c .

$a = 2, b = 3, c = -4$

**Full Credit
(15 Marks)**

- **Fully correct solution**

**Partial Credit
(13 Marks)**

- **Three variables found by correct method with errors**
- **Two variables solved correctly**

**Low Partial
Credit
(8 Marks)**

- **Some correct step**

Question 4

Part (a)	Scale 10C
Part (b)	Scale 10C
Part (c)	Scale 5A

- (a) Solve the simultaneous equations,
 $3x + 2y = 1$
 $x^2 + 2xy + 15 = 0$

$$y = \frac{17}{4}, -4 \quad x = -\frac{5}{2}, 3$$

Full Credit
(10 Marks)

- Fully correct solution

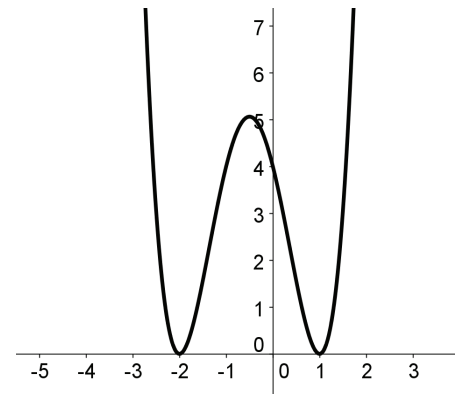
Partial Credit
(8 Marks)

- Solves both variables with correct method but with errors
- Only solves for one variable

Low Partial Credit
(5 Marks)

- Some correct step

- (b) Draw a sketch of the function $(x+2)(x-1)^2(x+2)$



Full Credit
(10 Marks)

- Fully correct solution

Partial Credit
(8 Marks)

- No more than one error in shape and/or roots

Low Partial Credit
(5 Marks)

- Any correct portion of the graph sketched

- (c) Estimate the values of x where the slopes of the tangents to the graph would be equal to zero.

$$x = 0, -0.5$$

Full Credit
(5 Marks)

- Correct values from candidates graph

Question 5

Part (a)
Part (b)

Scale 10C
Scale 15C

(a) Explain the terms injective and surjective.

An injective function never maps distinct elements of its domain to the same element of its codomain.

A function is surjective if every element in the codomain is mapped to an element in the domain but the mapping does not ensure that each element in the codomain is mapped to a distinct element in the domain.

Full Credit
(10 Marks)

- Fully correct explanation

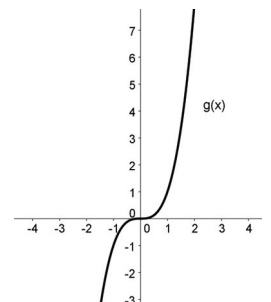
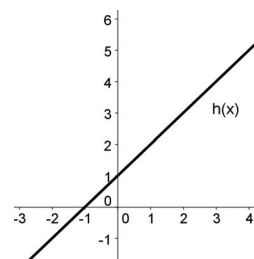
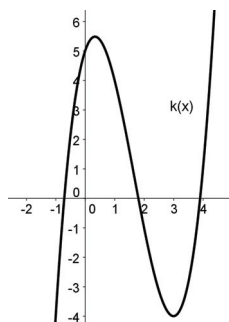
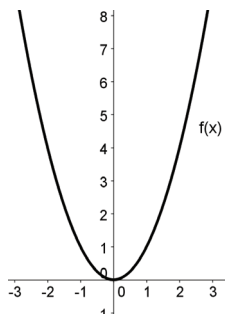
Partial Credit
(8 Marks)

- One correct explanation

Low Partial Credit
(5 Marks)

- Partially correct explanation for one or both terms.

(b) Examine the following functions and state whether each function is injective or surjective



$f(x)$

Surjective

$g(x)$

Surjective

$h(x)$

Injective

$k(x)$

Injective

Full Credit
(15 Marks)

- All correct

Partial Credit
(13 Marks)

- At least two correct

Low Partial Credit
(8 Marks)

- Only one correct

Question 6

Part (a)	Scale 5A
Part (b)	Scale 10C
Part (c)	Scale 10C

- (a) Explain the difference between a definite integral and an indefinite integral.

Explanation

- Full Credit**
(5 Marks)
- **Both explanations correct**

- (b) Give an example of a definite integral and an indefinite integral

An example of each required

- Full Credit**
(10 Marks)
- **Two correct examples**

- Partial Credit**
(6 Marks)
- **One correct example**

- (c) Find $\int_1^4 \ln x$

$$\int_1^4 \ln x = -\frac{3}{4}$$

- Full Credit**
(10 Marks)
- **Fully correct solution**

- Partial Credit**
(8 Marks)
- **Correct integration with arithmetic errors**

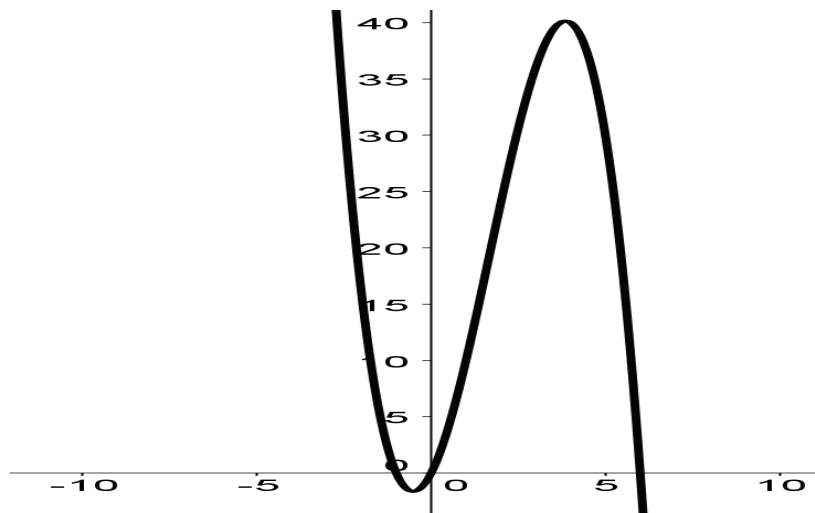
- Low Partial Credit**
(5 Marks)
- **Some correct step**

Question 7

Part (a)	Scale 15C
Part (b)	Scale 5A
Part (c)	Scale 10C
Part (d)	Scale 10C

The profits of a company, in hundreds of thousands of € can be modelled by the function, $p(m) = -m^2 + 5m^2 + 6m$ where m is the amount spent on advertising.

(a) Draw a suitable graph of the function to show the profit of the company



Full Credit
(15 Marks)

- **Correct graph with suitable domain chosen**

Partial Credit
(13 Marks)

- **Partially correct graph**

Low Partial
Credit
(8 Marks)

- **Incorrect graph with some correct substitution.**

(b) From your graph estimate the maximum profit of the company

Accept value from candidate graph

Full Credit
(5 Marks)

- **Correct value from candidates graph**

(c) Verify your answer from part (b) using differential calculus.

$$\frac{dP}{dm} = -3m^2 + 10m + 6 = 0$$
$$m_{\max} = 3.85$$

Full Credit
(10 Marks)

- **Fully correct solution**

Partial Credit
(8 Marks)

- **Derivative correct but solves incorrectly**
- **Error in differentiating once and solves correctly**

Low Partial
Credit
(6 Marks)

- **Any correct step**

(d) A sample of radioactive material decay can be modelled by the function $D(n) = ae^{bt}$

Where a and b are constants and t is the time passed in weeks. 50g of material are purchased and in 5 days it has decayed to 25g. Calculate the value of a and b .

$$50 = ae^0 \quad \therefore a = 50$$
$$b = \ln \frac{25}{50} = -0.6931472$$

Full Credit
(10 Marks)

- **Fully correct solution**

Partial Credit
(8 Marks)

- **Only one variable solved correctly**
- **Both variables solved but with minor error**

Low Partial
Credit
(6 Marks)

- **Any correct step**

Question 8

Part (a)	Scale 15C
Part (b)	Scale 10C
Part (c)	Scale 5B
Part (d)	Scale 15C
Part (e)	Scale 5B

Financial institutions use the formula, $B = P(1+i)^n - \frac{m[(1+i)^n - 1]}{i}$ to calculate the balance B , on a borrowed principal, P , at interest rate, i , for term n after m equal monthly repayments.

- (a) If the balance on the loan $B = 0$ after the n^{th} payment show that the monthly payment can be written as, $m = \frac{iP}{1-(1+i)^{-n}}$

If $B = 0$, $m = \frac{iP(1+i)^n}{[(1+i)^n - 1]}$

Divide by $(1+i)^n$

$$m = \frac{iP}{1-(1+i)^{-n}}$$

Full Credit
(15 Marks)

- Fully correct solution

Partial Credit
(13 Marks)

- Isolates m but fails to divide by $(1+i)^n$

Low Partial Credit
(8 Marks)

- Any correct step

- (b) John borrows €15,000 at a monthly rate of 0.65% for 36 months. Calculate his monthly repayment.

$$m = \frac{iP}{1-(1+i)^{-n}} \quad m = \frac{(0.0065)(15000)}{1-(1+0.0065)^{-36}} = \text{€}468.66$$

Full Credit
(10 Marks)

Fully correct solution

Partial Credit
(8 Marks)

- Correct substitution with arithmetic errors
- Incorrect handling of the percentage.

Low Partial Credit
(6 Marks)

- Any correct step

- (c) By how much would John's monthly repayment decrease if he borrows the money at the same rate but over a 5 year period?

$$m = \frac{(0.0065)(15000)}{1 - (1 + 0.0065)^{-60}} = €302.71$$

Reduction of €165.95

Full Credit (5 Marks) • **Fully correct solution**

Partial Credit (3 Marks) • **Any correct step**

- (d) John decides to borrow the money over a three year period. Calculate the balance of the loan as a percentage of the original borrowing after the 24th payment is made.

$$B = 15000(1 + 0.0065)^{24} - \frac{468.66[(1 + 0.0065)^{24} - 1]}{0.0065} = €5393.45$$

$$\frac{5393.45}{15000} \times 100 = 35.956\%$$

Full Credit (15 Marks) • **Fully correct solution**

Partial Credit (13 Marks) • **Fails to find percentage**
• **No more than two minor errors in calculation**

Low Partial Credit (8 Marks) • **Any correct step**

- (e) A bank offers a short term loan at a rate of 14.25% APR. Calculate the equivalent rate if compounded monthly.

$$1141.25 = 100[1 + i]^{12}$$

$$i = 0.1116342$$

Full Credit (5 Marks) • **Fully correct solution**

Partial Credit (3 Marks) • **Any correct step**

Question 9

Part (a)	Scale 10C
Part (b)	Scale 10B
Part (c)	Scale 10B
Part (d)	Scale 10B
Part (e)	Scale 10B

(a) Show that the $f(x) = \frac{-2}{x+3}$ has no turning points.

$$f'(x) = \frac{2}{(x+3)^2} \neq 0$$

Full Credit
(10 Marks)

- **Fully correct solution**

Partial Credit
(8 Marks)

- **Correct differentiation but incorrect or no conclusion**

Low Partial
Credit
(6 Marks)

- **Any correct step**

(b) Find the value $f'(0.5)$

$$f'(0.5) = \frac{-2}{0.5+3} = -\frac{4}{7}$$

Full Credit
(10 Marks)

- **Fully correct solution**

Partial Credit
(6 Marks)

- **Any correct step**

- (c) A cylinder has a height, h 5 times its radius, r . Express the volume of the cylinder in terms of r .

$$V = \pi r^2 \left(\frac{r}{5} \right) = \frac{\pi r^3}{5}$$

Full Credit
(10 Marks)

- **Fully correct solution**

Partial Credit
(6 Marks)

Some correct step

- (d) Express the rate of change in the volume of the cylinder in terms of r .

$$\frac{dV}{dr} = \frac{3}{5} \pi r^2$$

Full Credit
(10 Marks)

- **Fully correct solution**

Partial Credit
(6 Marks)

Some correct step

- (e) Determine the equation of the tangent to the curve $f(x) = x^3 + 3x^2 - 10x - 24$ at the point $(0, -25)$.

$$\begin{aligned} f'(0) &= 3(0)^2 + 6(0) - 10 = -10 \\ y + 25 &= -10(x - 0) \\ 10x + y &= -25 \end{aligned}$$

Full Credit
(10 Marks)

- **Fully correct solution**

Partial Credit
(6 Marks)

Some correct step

SOLUTIONS TO PAPER 2

QUESTION 1

Part (a)	Scale 10C
Part (b)	Scale 5B
Part (c)	Scale 10C

- (a) In a survey it was recorded that 315 people out of 540 had at least two penalty points on their licence. How many people would you expect to have at least two penalty points if 7500 people were surveyed?

$$\frac{315}{540} \times 7,500 = 4,375 \text{ people}$$

Full Credit (10 Marks)

- 4375 with or without work shown.

High Partial Credit (8 Marks)

- $\frac{315}{540}$ and stops.
- Multiplies 315 by 7500 and stops.

Low Partial Credit (6 Marks)

- Multiplies 540 by 7500 and stops.

(b) The probability of a cow producing twin calves is 0.46. If two cows are selected at random from a herd calculate the probability that:

(i) Neither will have twins.

$$P(\text{no twins}) = (0.54)^2 = 0.2916$$

Full Credit (5 Marks)

- Correct answer with or without work.

Partial Credit (3 Marks)

- Uses 0.46.

(ii) Only one will have twins.

$$P(\text{only one twin}) = 2(0.46)(0.54) = 0.4968$$

Full Credit (10 Marks)

- Correct answer with or without work.

High Partial Credit (8 Marks)

- Omits multiplication by 2 and continues ans = 0.2484.

Low Partial Credit (6 Marks)

- (0.46) or (0.56) used.

QUESTION 2

Part (a)	Scale 10C
Part (b)	Scale 5A
Part (c)	Scale 10C

- (a) The mark X , of an exam is normally distributed with a mean of 64 and a standard deviation of 8. If 200 students sit the exam, how many students would you expect to obtain a mark between 64 and 80?

$$80 - 64 = 16$$

$$16 \div 8 = 2 \quad \text{Standard Deviations}$$

95% of population between ± 2 standard deviations

As this is only dealing with the upper part of the symmetrical curve: $95\% \times 200 \div 2 = 95$ students.

Full Credit (10 Marks)

- Correct answer with work.

High Partial Credit (8 Marks)

- Answer of 190 students.
- Mentions 2 standard deviations or 95%.

Low Partial Credit (6 Marks)

- $80 - 64 = 16$ and stops.

- (b) Which one of the following pairs of variables is likely to have a causal relationship?
Write your answer in the box.

- (i) Sales of televisions and sales of DVD players.
- (ii) **A cars weight and its petrol consumption. ✓**
- (iii) A person's height and their reading ability.

Full Credit (5 Marks)

- Correct answer shown.

- (c) The National Lottery held its first draw on the 23rd of March 1987. A contestant had to match 6 numbers from a possible 36 numbers. The lottery cost £0.50 pence to play per panel. In 1992 6 extra numbers were added to the draw after a calculated scheme by a syndicate headed by Stefan Klincewicz profited by more than £300,000. By comparing the possible number of combinations, explain why the National Lottery took this action.

1987

Total number of combinations = ${}^{36}C_6 = 1,947,792$

$$\text{Odds of winning lotto} = \frac{1}{1,947,792}$$

Cost of Lotto = $1,947,792 \times 0.50 = \text{£}973,896$

1992

Total number of combinations = ${}^{39}C_6 = 3,262,623$

$$\text{Odds of winning lotto} = \frac{1}{3,262,623}$$

Cost of Lotto = $3,262,623 \times 0.50 = \text{£}1,631,311.50$

By increasing the number of numbers the total number of combinations increased from 1,947,792 to 3,262,623. This increase also dramatically increased the cost of trying to complete all combinations.

(Corrector: Be liberal with students explanation for this section)

Full Credit (10 Marks)

- Correct answer with work.

High Partial Credit (8 Marks)

- Correct conclusion without work.
- Works out number of combinations with incorrect or no conclusion.
- Incorrect work with combinations with correct conclusion.

Low Partial Credit (7 Marks)

- Incorrect work with combinations and incorrect conclusion.
- Works with permutations.

QUESTION 3

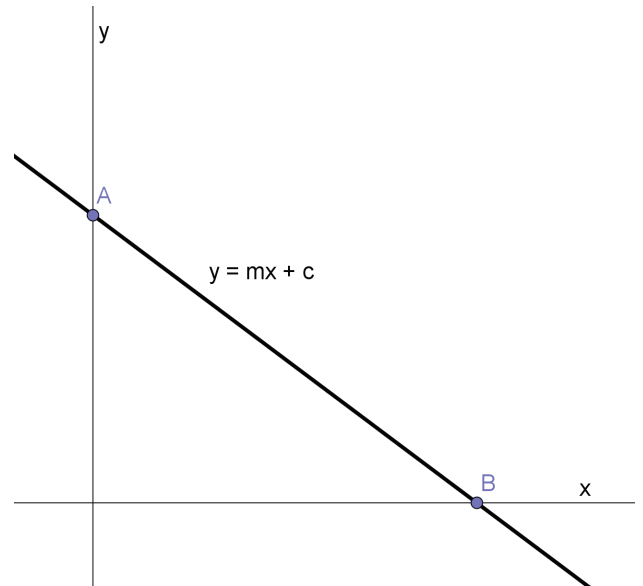
Part (a)

Scale 5B

Part (b)

Scale 20C

The line $l: y = mx + c$ contains the point $(4, 3)$ and forms a triangle of area 24 square units with the x -axis and the y -axis. The points A and B are also on the line l as shown.



(a) Express c in terms of m .

$$3 = 4m + c$$

$$\therefore 3 - 4m = c$$

Full Credit (5 Marks)

- Correct answer with or without work.

Partial Credit (3 Marks)

- Any relevant substitution into equation of line.
- Attempts to find point A or B.

(b) Find the equation of the line l .

$$\text{Point } B\left(-\frac{c}{m}, 0\right) \quad \text{Point } A(0, c)$$

$$\text{Area of Triangle} = \frac{1}{2}\left(-\frac{c}{m}\right)(c) = -\frac{c^2}{2m}$$

$$\therefore -\frac{c^2}{2m} = 24$$

$$-c^2 = 48m$$

$$-(3-4m)^2 = 48m$$

$$16m^2 + 24m + 9 = 0$$

$$\therefore m = -\frac{3}{4} \quad \text{and} \quad c = 6$$

$$y = -\frac{3}{4}x + 6$$

Full Credit (20 Marks)

- Correct answer with work.

High Partial Credit (18 Marks)

- Point A and B correct.
- Area equation correctly or incorrectly formed and continues to solve.

Low Partial Credit (10 Marks)

- Point A or B correct.
- Attempts to form equation for area.
- Attempts to work points from graph.

QUESTION 4

Scale 25D

A circle of radius length 5 contains the point $(2, -1)$. The centre of the circle lies on the line $x + y = 8$. Find the equations of the two circles which satisfy these conditions.

$$\text{Radius: } g^2 + f^2 - c = (5)^2 = 25$$

$$(2, -1) \text{ lies on circle } \therefore (2)^2 + (-1)^2 + 2g(2) + 2f(-1) + c = 0$$

$$\therefore 4g - 2f + c = -5$$

$$(-g, -f) \text{ lies on } x + y = 8 \therefore g = -f - 8$$

$$(-j - 8)^2 + f^2 - (6f + 27) = 25$$

$$f^2 + 5f + 6 = 0 \therefore \text{if } f = -2, g = -6 \text{ and if } f = -3, g = -5$$

$$c_1 : (x - 5)^2 + (y - 3)^2 = 25$$

$$c_2 : (x - 6)^2 + (y - 2)^2 = 25$$

Full Credit (25 Marks)

- Correct answer with work.

High Partial Credit (23 Marks)

- Correct method with mirror errors leading to two incorrect equations.
- Forms a correct quadratic in f or g .
- Two correct equations.

Mid Partial Credit (20 Marks)

- Subs $(2, -1)$ into correct equation.
- At least one correct equation.

Low Partial Credit (15 Marks)

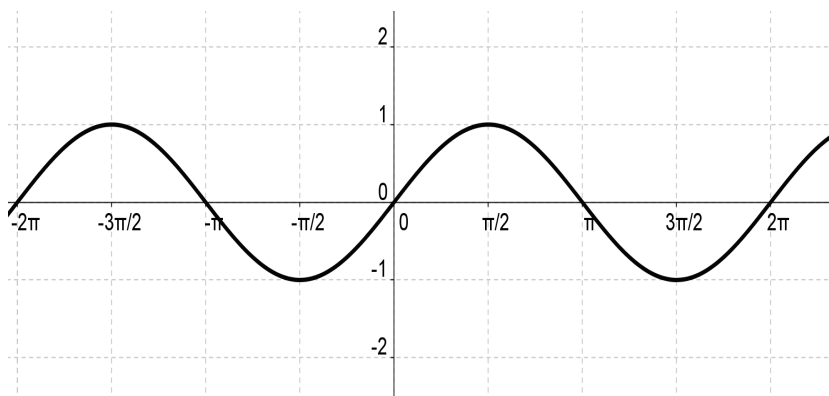
- Subs $(2, -1)$ into incorrect equation.
- Writes 25.
- Any correct work.

QUESTION 5

Part (a) (i)
(ii)

Scale 10B
Scale 15B

The graph of the function $f : x \mapsto a \sin(bx)$, where $a = 1$ and $b = 1$ is shown below.



By drawing a graph in the grid above, or otherwise, explain how the shape of the graph will be affected:

(a) If a is multiplied by a factor of n , where $n \in \mathbb{N}$.

The height/amplitude of the wave increases.

Full Credit (10 Marks)

- Correct graph drawn with any value of $a \in \mathbb{N}$ and correct statement.

Partial Credit (6 Marks)

- Correct conclusion without a graph drawn.
- Correct graph drawn with any value of $a \in \mathbb{N}$ and incorrect statement.

(b) If b is multiplied by a factor of n , where $n \in \mathbb{N}$.

The period of the wave decreases
The frequency of the wave increases
(Be liberal)

Full Credit (15 Marks)

- Correct graph drawn with any value of $a \in \mathbb{N}$ and correct statement.

Partial Credit (7 Marks)

- Correct conclusion without a graph drawn.
- Correct graph drawn with any value of $a \in \mathbb{N}$ and incorrect statement.

QUESTION 6A

Part (a)

Scale 10B

Part (b)

Scale 15B

(a) Explain the term *corollary*?

A corollary is a statement that follows from an already proved theorem.

Full Credit (10 Marks)

- Correct statement.

Partial Credit (6 Marks)

- Partially correct statement.

(b) Give an example, and fully explain one corollary you have studied. Make reference to the theorem from which it originates.

Full Credit (15 Marks)

- Correct corollary stated and explanation of how it is derived from an already proven theorem.

Partial Credit (7 Marks)

- Correct corollary stated and explained without reference to correct theorem.
- Corollary stated incorrectly with reference to correct theorem.

QUESTION 6B

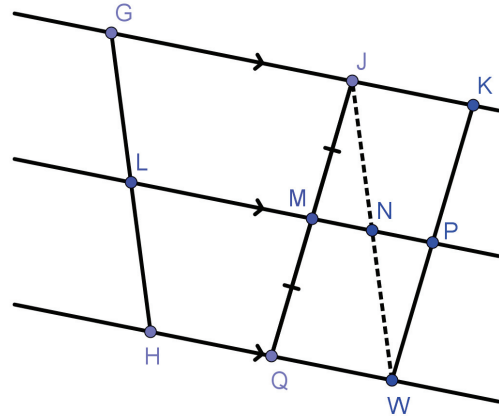
Scale 25D

Prove that if three parallel lines cut off equal segments on some transversal line, then they will cut off equal segments on any other transversal line.

Given: $GK \parallel LP \parallel HW$ and $|JM| = |MQ|$

To prove: $|GL| = |LH|$

Construct: $|QW| = |QH|$, $KW \parallel JQ$, $JN \parallel GL$



Proof: $|PW| = |MQ|$ (opposite sides of a parallelogram)

$\therefore |JM|$

$|\angle MJN| = |\angle NWP|$ (alternate angles)

$|\angle JNM| = |\angle PNW|$ (opposite angles)

$\therefore \triangle MJN = \triangle NWP$ by *ASA*

$\therefore |JN| = |NW|$

but $|JN| = |GL|$ and $|WN| = |HL|$

$\therefore |GL| = |LH|$

Accept alternate labelling of points and steps in different order

Full Credit (25 Marks)

- Correct construction with correct proof and at least two reasons.

High Partial Credit (23 Marks)

- Correct construction with correct proof and less than two correct reasons.
- Correct construction with one omission in proof.
- Incorrect construction with fully correct proof.

Mid Partial Credit (20 Marks)

- Correct construction with incorrect proof.
- Correct construction with more than one omission in proof.
- Incorrect construction with proof containing more than one omission.

Low Partial Credit (15 Marks)

- Incorrect construction and no proof or worthless proof.
- One correct step in either construction or proof.

QUESTION 7

Part (a)	Scale 15C
Part (b)	Scale 10B
Part (c)	Scale 10B
Part (d) (i)	Scale 15C
(ii)	Scale 5B
(iii)	Scale 5B
Part (e)	Scale 10C
Part (f)	Scale 5A

- (a) Use a suitable graphical means to display the number of fatalities on Irish roads between 1992 and 2008.

Any correct suitable graphical representation of data.

Full Credit (15 Marks)

- Suitable and fully correct graphical display.

High Partial Credit (13 Marks)

- Suitable graphical display with two or less errors.

Low Partial Credit (9 Marks)

- Suitable graphical display with two or more errors.
- Incorrect graphical display chosen.

- (b) A student wishes to compare the figures in the table based on gender and age. Suggest the best measures and graphs for the student to use and explain your answer fully.

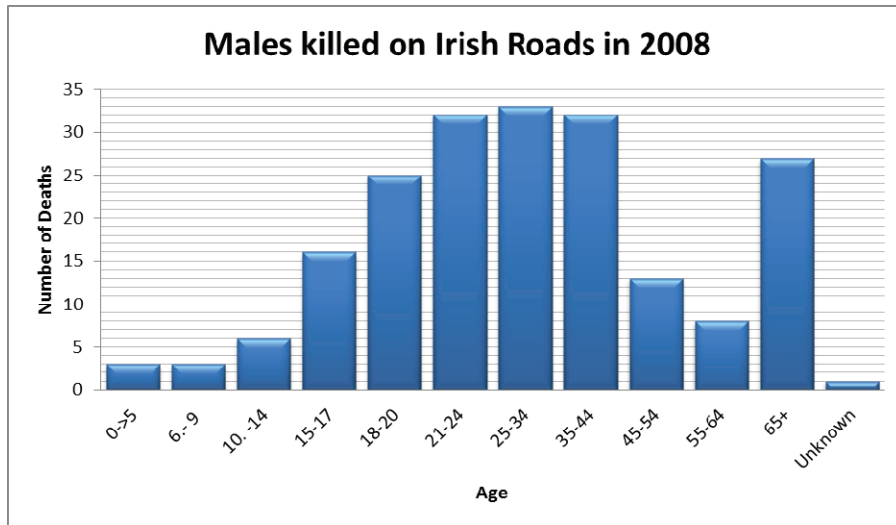
Full Credit (10 Marks)

- Suitable display chosen and mentions two measures from median, mean, range, mode.

Partial Credit (6 Marks)

- Suitable graphical display with one or no measures mentioned.
- Measures mentioned but incorrect or unsuitable graph chosen.

- (c) A student compiled the following graph. Examine the graph and comment on the shape and the mean of the distribution.



The distribution is almost symmetrical. The 65+ bar distorts the symmetry. This would raise the mean age of males killed on roads.

Full Credit (10 Marks)

- Discusses both the shape and the symmetry.

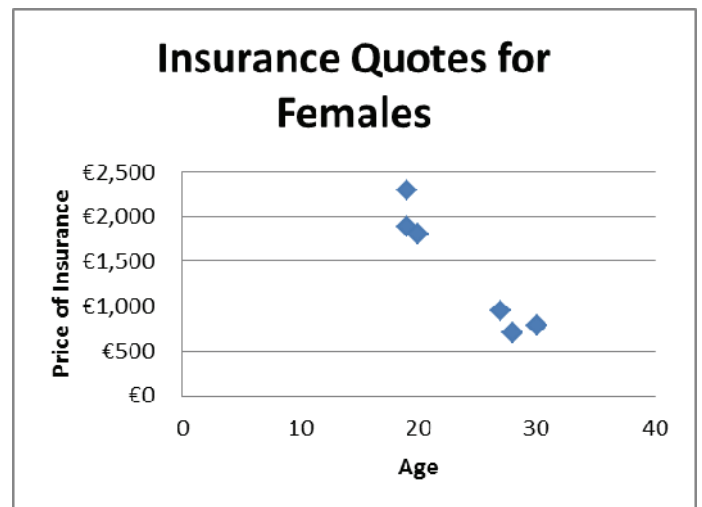
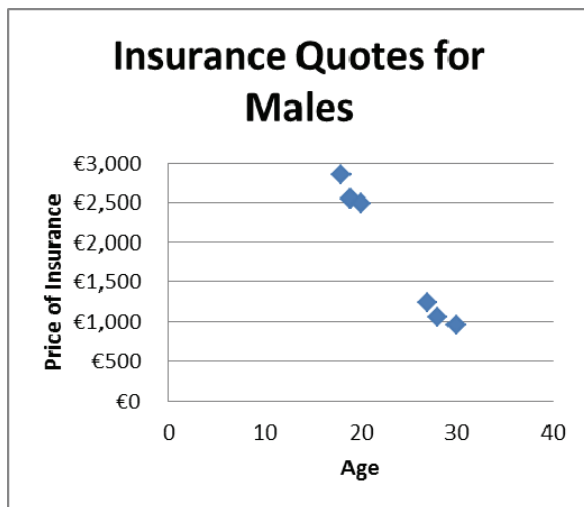
Partial Credit (6 Marks)

- Discusses the symmetry or the mean only.
- Incorrect comment on mean with correct observation on shape.

- (d) A number of males and females of different ages were quoted for fully comprehensive insurance on a car of engine size 1.4l. The quotes were recorded as follows:

Male		Female	
Age	Quote	Age	Quote
19	€2550	19	€1890
27	€1250	27	€950
30	€950	30	€790
18	€2850	19	€2300
20	€2490	20	€1800
28	€1060	28	€700

- (i) Draw a scatter plot for both sets of data.



Full Credit (15 Marks)

- Two correct Scatter plots.

High Partial Credit (13 Marks)

- One correct scatter plot.

Low Partial Credit (9 Marks)

- Correctly labelled axis with at least one correct point on one scatter plot.

- (ii) Comment on the correlation between the age and insurance costs for both male and female drivers.

Both sets of figures show a strong negative correlation which suggests that a drivers age has an effect on the cost of insurance.

Full Credit (5 Marks)

- Correct observation.

Partial Credit (3 Marks)

- Partially correct observation.

- (iii) Comment on the relation between the figures released in the RSA reports on road fatalities and the cost of insurance for Irish motorists.

Correctly identifies the high number of accidents/ fatalities in certain age groups and correlates to high cost of insurance.

Full Credit (5 Marks)

- Correct observation.

Partial Credit (3 Marks)

- Partially correct observation.

- (e) The ages of males killed on Irish roads between the ages of 0 and 65 years of age is assumed to be normally distributed with a mean of 28.7 years and a standard deviation of 5.8 years. If an accident occurred, resulting in the death of a male, what is the probability that the male will be between the age of 17.1 years and 40.3 years.

$28.7 - 17.1 = 11.6$ years = Two Standard deviations from the mean
 $40.3 - 28.7 = 11.6$ years = Two Standard deviations from the mean
 \therefore 95% chance

Full Credit (10 Marks)

- Correct solution explained or calculated.

High Partial Credit (8 Marks)

- Correct solution with no explanation or calculations.

Low Partial Credit (6 Marks)

- Some correct attempt at finding solution.

- (f) Examine the following table and comment on the success or failure of the work taht the RSA is carry out in Irish society.

Road fatalities by transport mode, 2000-2010

Road User Type	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Pedestrians	85	89	86	64	70	74	73	81	49	40	41
Pedal Cyclists	10	12	18	11	11	10	9	15	13	7	3
Motor Cyclists	39	50	44	55	50	56	29	33	29	25	17
Car Users	260	230	200	172	208	222	226	171	160	146	133
PSV Users	0	0	1	0	0	6	3	1	0	1	1
Goods Vehicle	17	26	20	27	25	22	18	32	20	17	13
Other or Unknown	4	4	7	6	10	6	7	5	8	2	4
TOTAL	415	411	376	335	374	396	365	338	279	238	212

Comments on the falling numbers of fatalities since 2000 as a result of successful work/campaigns by RSA

Full Credit (5 Marks)

- Correct statement.

QUESTION 8

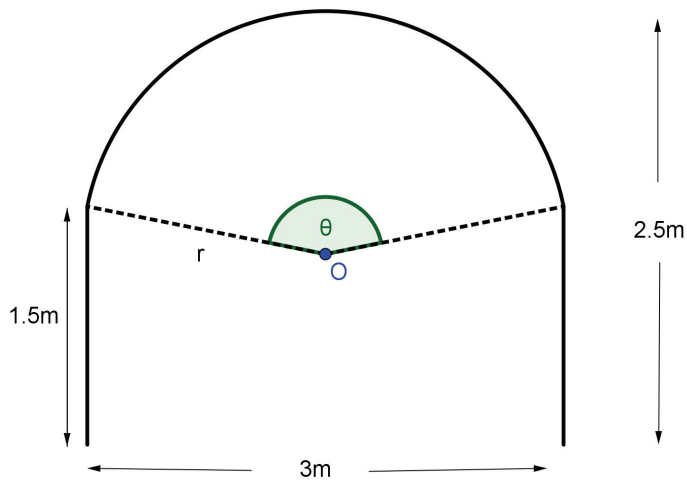
Part (a)	Scale 10B
Part (b)	Scale 10B
Part (c)	Scale 25C
Part (d)	Scale 15C
Part (e)	Scale 10B
Part (f)	Scale 5B

A group of Transition Year students have designed and are constructing a poly tunnel as part of the Green Schools Initiative.

The tunnel is 6m in length, divided into three equal sections.

The end view for each section is shown.

Each section is joined by two horizontal bars while a single support runs along the top from the front to the back.



- (a) Calculate the length of bar required to make the straight bars for each section of the tunnel.

$$(12 \times 2) + (8 \times 1.5) + 6 = 42 \text{ m}$$

Full Credit (10 Marks)

- Correct solution.

Partial Credit (6 Marks)

- Some calculation errors.

- (b) The students realise they need to make the straight vertical bars 20% longer so that they can bury part of the bar in the ground. What is the extra length of bar required?

$$8(1.5 \times 0.2) = 2.4 \text{ m}$$

Full Credit (10 Marks)

- Correct solution.

Partial Credit (6 Marks)

- Some calculation errors.

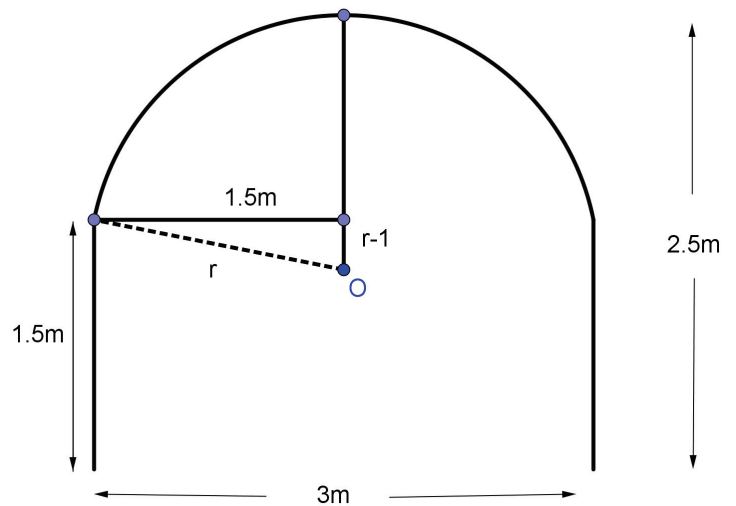
- (c) If centre of the arc is at point O calculate the radius of the arc.

$$r^2 = 1.5^2 + (r-1)^2$$

$$r^2 = 2.25 + r^2 - 2r + 1$$

$$2r = 3.25$$

$$r = 1.625 \text{ m}$$



Full Credit (25 Marks)

- Fully correct solution.

High Partial Credit (17 Marks)

- Some calculation errors.

Low Partial Credit (8 Marks)

- Valid attempt at finding radius.
- Correct addition to diagram.

(d) Calculate the angle θ correct to one decimal place.

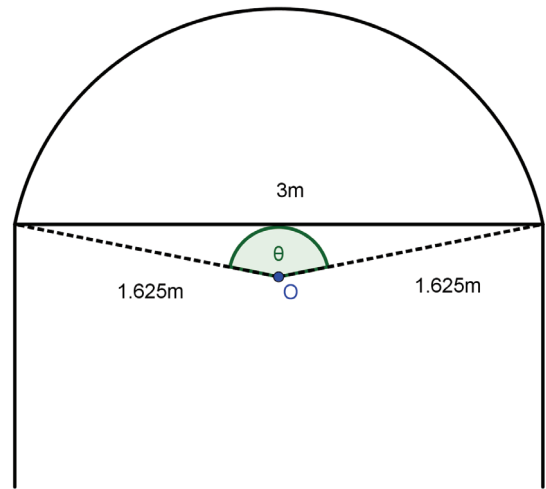
$$a^2 = b^2 + c^2 - 2bc \cos a$$

$$(3)^2 = (1.625)^2 + (1.625)^2 - 2(1.625)(1.625) \cos \theta$$

$$\frac{9 - 5.28125}{-2(1.625)(1.625)} = \cos \theta$$

$$\therefore \theta = \cos^{-1} \left(\frac{9 - 5.28125}{-2(1.625)(1.625)} \right)$$

$$\therefore \theta = 134.8^\circ$$



Full Credit (15 Marks)

- Fully correct solution.

High Partial Credit (13 Marks)

- Some calculation errors.

Low Partial Credit (9 Marks)

- Valid attempt at finding angle.
- Correct addition to diagram.

- (e) Calculate the length of the arc correct to two decimal places.

$$\text{Arc Length} = 2\pi r \times \frac{\theta}{360}$$

$$\text{Arc Length} = 2\pi(1.625) \times \frac{134.8}{360}$$

$$\text{Arc Length} = 3.82 \text{ m}$$

Full Credit (10 Marks)

- Fully correct solution.

Partial Credit (6 Marks)

- Some calculation errors.

- (f) If a door measuring $0.5 \text{ m} \times 1 \text{ m}$ will be placed at the front of the tunnel, calculate the amount of covering needed to fully enclose the tunnel correct to the nearest metre.

$$(6 \times 1.5 \times 2) + (6 \times 3.82) + (3 \times 1.5 \times 2) + \left(2 \times \pi (1.625)^2 \times \frac{134.8}{360} \right) - \left(2 \times \frac{1}{2} (1.625)^2 \sin(134.8) \right) - (0.5 \times 1) = 54 \text{ m}$$

Full Credit (5 Marks)

- Fully correct solution.

Partial Credit (3 Marks)

- Any correct step.