




Lenzie Academy



HEINEMANN HIGHER CHECKLIST

- I understand this part of the course = 
- I am unsure of this part of the course = 
- I do not understand this part of the course = 

Name _____ Class _____ Teacher _____

Higher Course Checklist – Heinemann

Topic 1 - Straight Line



1. Know gradient and distance formula
pg1 Ex 1A Q1,3
2. Know gradient of parallel lines are equal
pg1 Ex 1A Q5
3. Show points are collinear
Pg3 Ex 1B Q1,2
4. Know $\tan\theta = m$
Pg2 Ex 1A Q9,10
5. Know that lines with gradients m_1 and m_2 are perpendicular if $m_1 \times m_2 = -1$
Pg6 Ex 1D Q1-8
6. Know the equation of the line $y - b = m(x - a)$ and $ax + by + c = 0$
pg11 Ex 1G Q1,2
7. Determine the equation of the line from 2-points or 1-point and gradient
pg10 Ex 1F Q2
8. Determine the equation of the Altitudes.
pg15 Ex 1K Q1,2
9. Determine the equation of Medians.
pg16 Ex 1M Q1,2
10. Determine the equation of Perpendicular Bisectors.
Pg13 Ex 1I Q1

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Topic 2 – Functions & Graphs



1. Understand what the Domain and Range of a function are and how to get them)
Pg24 Ex 2B Q1-7
2. Recognise a Composite Function as $h(x) = g(f(x))$ and be able to find $h(x)$ when given $g(x)$ and $f(x)$
pg26 Ex 2C Q5
3. Understand what the inverse of a function is and how to calculate it *pg28 Ex 2D Q2-5*
4. Be able to graph an inverse function by reflection in the line *pg29 Ex 2F Q1,2*
5. Know general features of the graphs of exponential and logarithmic functions
Pg30-31 Ex 2G Q1,2 /Ex2H Q1,2
6. Solve problems using properties of functions
pg31Mixed Exercise Q1-7
7. Given graphs of $f(x)$ draw and be able to recognise key features of graphs of $F(x) + a$, $F(x+a)$, $-F(x)$, $F(-x)$, $kF(x)$, $F(kx)$
Pg48 Ex 3P Q2,4,6,7,8
8. Find the equation of the exponential function from 2-points on a graph
Pg45 Ex 3N Q1-4
9. Find the equation of the logarithmic function from a graph
Pg47 Ex 30 Q1-3

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Topic 3 – Trigonometric Functions



1. Know the meaning of the word Amplitude and Period
Pg53 Ex 4A Q1-3
2. Know the general features of Sine and Cosine graphs
 $\sin(ax+b)$, $\cos(ax+b)$, $a \sin bx$, $a \cos bx$
3. Know π radians = 180°
4. Know and be able to use the table of exact values
Pg59 Ex 4E Q1,2
5. Solve problems using exact values
Pg61 Ex 4F Q1-4
6. Solve equations of type $f(x)=g(x)$ graphically
Pg62 Ex 4G Q4,5,6
7. Solve 3-types of equations algebraically in a given interval
 $2\sin 4x + \sqrt{3} = 0$, $\tan^2 x = 3$, $3\sin^2 x - 4\sin x + 1 = 0$
Pg63 Ex 4H Q1-5
8. Solve compound angle equations algebraically
Pg65 Ex 4I Q-4
9. State Max/Min value of a function giving corresponding x-value
Pg67 Mixed Ex Q12,13

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Topic 4 – Linear Recurrence Relations



1. Using Define/interpret a recurrence relation of the form

$$U_{n+1} = mU_n + C$$

Pg71 Ex 5B Q1-4

2. Solve problems involving recurrence relations

Pg72 Ex 5C Q5-9

3. State the condition for the limit of a recurrence relation to exist.

4. State whether a sequence will converge or diverge from its recurrence relation.

Pg74 Ex 5E Q1 Pg75 Ex 5F Q1

5. Find, where possible, and interpret the limit of a sequence resulting from a recurrence relation

Pg78 Ex 5H Q3-6

6. Solve recurrence relations to find a and b.

Pg79 Ex 5I Q-4

7. Solving recurrence relation problems written in context.

Pg82 Ex 5L Q3-5

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Topic 5 – Differentiation 1



1. Use the notation $\frac{dy}{dx}$ and $f'(x)$ for a derivative
2. Know that if $f(x) = ax^n$, then $f'(x) = anx^{n-1}$
if $f(x) = g(x) + h(x)$, then $f'(x) = g'(x) + h'(x)$
Pg91 Ex 6D Q1-40
3. Know the meaning of Rate of Change and be able to solve problems involving applications of Derivatives.
Pg92 Ex 6E Q1,3
4. Be able to find the derivatives of Products and Quotients.
Pg95 Ex 6G Q1-27
5. Know that the gradient of a curve is equal to gradient of a tangent at tangent point.
Pg93 Ex 6E Q4
6. Be able to find m of tangent to a curve $y = f(x)$ at $x=a$.
Pg101 Ex 6J Q1
7. Find the equation of a tangent at any point on a curve.
Pg101 Ex 6J Q 4,5
8. Find points on a curve where gradient has particular values.
Pg101 Ex 6J Q7,8
9. Understand Increasing and decreasing functions.
- If $f'(x) > 0$ then $f(x)$ is increasing
- If $f'(x) < 0$ then $f(x)$ is decreasing.
Pg104 Ex 6L Q3-8
10. Find the stationary points and determine their nature.
Pg106 Ex 6M Q1-4

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Topic 5 – Differentiation 1 Continued



11. Sketch curves by finding stationary points, nature, intersection with axes, behaviour of y for large +ve/-ve x -values.
Pg107 Ex 6N Q1-4
12. Find the max/min value of a function in a closed interval
Pg109 Ex 60 Q1,2
13. Graph the derived function $f'(x)$
Pg110 Ex 6P Q1-9
14. Solve optimization problems using Calculus.
Pg113 Ex 6R Q1-5
15. Mixed questions.
Pg115 Ex 6S Q12-19

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Topic 6 – Polynomials



- 1a. Use the remainder theorem to divide a polynomial $f(x)$ by $(x - h)$
pg135 Ex7C Q1,3,5
- b. Be able to state the answer in the form $f(x) = (ax - b)Q(x) + R$
pg129 Ex7C Q3,4
2. Determine roots of a polynomial equation.
pg134 Ex 7G Q 2,4
3. Factorise a polynomial using the remainder theorem.
Hence be able to solve
1) any polynomial equation *pg137 Ex7E Q 7* 2) Sketch any polynomial *pg143 Ex 7I Q 1-9*
4. Find polynomials unknown coefficients using the factor theorem.
pg138 Ex 7F Q1,2
5. Be able to establish the equation of a polynomial from its graph or when given its roots.
pg135 Ex 7H All questions
6. Prove that an equation has a root between two given values and be able to improve on that.
pg138 Ex 7J Q1,2

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Chapter 8 – Quadratic Theory



1. Know that a quadratic function $y = ax^2 + bx + c = 0$ has a max turning point if $a > 0$, Min turning point if $a < 0$, that it has y intercept $(0, c)$, and can find the zeros of the function by solving $ax^2 + bx + c = 0$.
pg150 Ex 8C Q1
2. Write the equation $y = ax^2 + bx + c$ in the form $y = a(x + p)^2 + b$ and then be able to state that the axis of symmetry is $x = -p$, the turning point is at $(-p, q)$.
3. Sketch quadratic functions.
pg152 Ex 8D Q2
4. Solve quadratic equations by graphing, factorising, completing the square, using quadratic formula.
Pg153 Ex 8E Q3
5. Solve quadratic inequations using a sketch of the function.
Pg154 Ex 8F Q3
6. Know that the discriminant of $ax^2 + bx + c$ is $b^2 - 4ac$ and be able to use the discriminant to determine the nature of the roots of a quadratic.
Pg157 Ex 8H Q2
7. Use the discriminant to find the condition that roots of a quadratic are real and equal or unequal.
Pg158 Ex 8I Q1
8. Be able to determine whether a line cuts, touches or does not meet a curve by substituting the equation of the line into the equation of the curve.
Pg159 Ex 8I Q8
9. Know the condition for tangency.
pg161 Ex 8J Q1
10. Mixed questions. **pg162Ex 8K Q1,2**

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Chapter 9 – Basic Integration



1. Know that $\int ax^n = a \int x^n dx = \frac{ax^{n+1}}{n+1} + C$, $C \neq -1$
 where C is the constant of integration.
Pg170 Ex 9H Q1
2. $\int (f(x) + g(x))dx = \int f(x)dx + \int g(x)dx$
pg170 Ex 9H Q3
3. Write all the integrals in the form ax^n , where a is a constant, before integrating.
Pg171 Ex 9I
4. Be able to write a shaded area as a definite integral.
 Sketch a shaded area from a definite integral.
pg173 Ex 9K Q1,2
5. Evaluate definite Integrals
pg174 Ex 9L
6. Determine the area between a curve $y = f(x)$,
 x-axis and the lines $x=a$ and $x=b$.
pg177 Ex 9N Q1,2
7. Determine the area bounded by two curves
Pg180 Ex 9P Q1
8. Solve differential equations of the form $\frac{dy}{dx} = f(x)$
pg181 Ex 9Q Q2,3
9. Mixed Integration examples.
pg182 Ex 9R

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Chapter 11 – Trig Formulae



1. Solve more complex problems using the addition formulae
pg198 Ex 11E
2. Be able to apply the Double Angle Formulae to simplify trig equations. *pg199 Ex 11F*
3. a. Solve trigonometric equations with Double Angles
b. Solve trigonometric equations involving $\sin^2 x$, $\cos^2 x$ or both using Double Angle formulae.
Pg203 Ex 11H Q1,2
4. Mixed Questions
Pg206 Ex 11J

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Chapter 12 – The Circle



1. Know the Distance Formula and how to use it
Pg211 Ex 12B Q1
2. Know the equation of a circle centre (0, 0) and radius r is
 $x^2 + y^2 = r^2$
pg212 Ex 12D Q1-3,7,10
3. Know the equation of a circle centre (a, b) and radius r is
 $(x - a)^2 + (y - b)^2 = r^2$ **pg215 Ex 12F Q1,2,8,10**
4. Know that $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle centre (-g, -f) and radius $\sqrt{(g^2 + f^2 - c)}$ provided $g^2 + f^2 - c > 0$
Pg218 Ex 12H Q3,5
5. Be able to find the points of intersection of a line and circle. **Pg222 Ex 12J Q3**
6. Prove a line is a tangent to a circle. **Pg223 Ex 12K Q2,3**
7. Determine whether a line and circle have 2, 1, or no points of intersection. **Pg223 Ex 12K Q6**
8. Be able to find the equation of a tangent to a circle
Pg225 Ex 12L Q1-3
9. Mixed Questions
pg225 Ex 12M All questions

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Chapter 13 – Vectors



1. Know what the following terms are and be able to find them in 2-D and 3-D: vector, magnitude, direction, scalar, position vector, unit vector, zero vector, directed line segment, component, scalar product.

2D-Ex 13A/13B/13F/13G

2. Know addition, subtraction and multiplication properties of vectors.

3D pg256 Ex 13N Q1-13

3. Determine the distance between two points in 3-D
4. Know that for parallel vectors $v = ku$.
5. Determine whether 3 points are collinear in 3-D.
pg258 Ex 13N Q15-18
6. Be able to divide a line in a given ratio using the section formula. **Pg258 Ex 13N Q19,20**

7. Know and apply the basis vectors i, j, k .
Pg254 Ex 13M Q1-4

8. Know the scalar product facts and how to use them to find the angle between vectors.

$$a \cdot b = |a||b|\cos\theta$$

$$a \cdot b = a_1b_1 + a_2b_2 + a_3b_3$$

pg259 Ex 13Q Q1

9. Know the properties of the scalar product
 - 2 vectors are perpendicular if $a \cdot b = 0$
 - For vector a and b , $a \cdot b = b \cdot a$
 - For vector a, b and c $a \cdot (b + c) = a \cdot b + a \cdot c$

P263 Ex 13R Q1,2,5 pg266 Ex 13U Q1,2,5

10. Mixed questions
Pg267 Ex 13V

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Chapter 14 – Further Calculus



1. Know and apply the facts that:-
 If $f(x) = \sin x$ $f'(x) = \cos x$
 If $f(x) = \cos x$ $f'(x) = -\sin x$
Pg273 Ex 14B Q1-6

2. Know and apply the fact that:-
 $\int \cos x \, dx = \sin x + C$
 $\int \sin x \, dx = -\cos x + C$
Pg274 Ex 14C Q1-7

3. Be able to differentiate functions of the form
 $(x + a)^n$ and $(ax + b)^n$
Pg276 Ex 14E Q1,2

4. Be able to differentiate trig functions eg
 $\sin 3x, \cos^3 x, \cos(2x + \frac{\pi}{3}), \sin^2 x$ using the chain rule
Pg280 Ex 14H Q2-5

5. Solve problems involving applications of differentiation
Pg281 Ex 14I Q1-7

6. Be able to integrate functions of the form $(ax + b)^n$
Pg283 Ex 14J Q1-8

7. Know and apply the rule that
 $\int \sin(ax + b) \, dx = \frac{-1}{a} \cos(ax + b) + C$
 $\int \cos(ax + b) \, dx = \frac{1}{a} \sin(ax + b) + C$
Pg284 Ex 14K Q1-8

8. Mixed Questions
Pg285 Ex 14L Q10-15

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Chapter 15 – Logs and Exponentials Functions



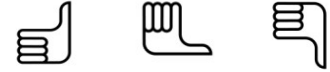
1. Know that a function of the form $y = a^x$ is an exponential function to the base a , $a \neq 0$
2. Know that when we graph an exp function $y = a^x$
 If $a > 1$ the graph is always positive,
 never crosses the x-axis,
 is increasing, passes through (0, 1)

 If $0 < a < 1$, the graph is always positive,
 never crosses the x-axis,
 is decreasing, passes through (0, 1).
3. Solve basic problems involving exp growth/decay.
Pg292 Ex 15C Q1-10
4. Know that a function of the form $y = e^x$
 is called the exponential function to the base e
 Be familiar with the exp button on the calculator
5. Know that
 If $y = a^x$ then $x = \log_a y$
 $y = \log_a x$ then $x = a^y$
Pg295 Ex 5E Q1-3
6. Know and be able to use the laws of logarithms.
Pg296 Ex 15F Q1-8
7. Simplify numerical expressions using the laws of logs.
Pg297 Ex 15G Q1-3
8. Know that logarithms to the base e are called natural Logarithms, written $\log_e x = \ln x$
 b. Solve logarithmic and exponential equations eg.
 $\ln x = 9$ $e^{2x} = 16$ $7^x = 25$
Pg298 Ex 15H All Q

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Chapter 15 – Logs and Exponentials continued



9. Know that we can express $y = kx^n$ in the form of the equation of the straight line
 - If $y = kx^n$ then $\log y = n \log x + \log k$
 and draw a graph of $\log y$ against $\log x$.
Pg300 Ex 15I Q1,2
- b. Be able to deduce the values of k and n such that $y = kx^n$, using two points on the line.
- 10a. Know that if $y = ab^x$, then $\log y = \log a + x \log b$
- b. Be able to deduce the value of a and b such that $y = ab^x$, using two points on the line.
Pg303 Ex 15J Q1-3
11. Know from the graphs of $y = e^x$ and $y = \ln x$ and techniques learned in chapter 3, graphs and functions, how to sketch related graphs.
Pg305 Ex 15K Q1-4
12. Mixed questions.
Pg306 Ex 15L Q1-12

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Chapter 16 – The Wave Function

1. Be able to express $a \cos \theta + b \sin \theta$ in the form

$$k \cos(x \pm \alpha) \text{ or } k \sin(x \pm \alpha)$$

where k is the amplitude and α the phase angle

Pg314 Ex 16E Q1-5

2. Be able to apply the wave function formula to multiple angles **Pg315 Ex 16F Q1-3**

3. Be able to find the max/min of a function of the form $a \cos x + b \sin x$ by expressing it as a single trig function **Pg316 Ex 16G Q1-11**

3. Be able to solve equations involving $a \cos x + b \sin x$ by using the wave function formula. **Pg318 Ex 16H Q1-4**

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