Revision – Additional Mathematics

F4.1 - Functions

1. Set A = {4, 8, 12} is related to set B = {2, 3, 4 ,5} by the relation 'is divisible by'. Represent this relation using (a) an arrow diagram, (b) ordered pairs and (c) a graph.

   Then (d) identify the domain and codomain of the relation. (e) identify the object(s) of 3. (f) state the range. (g) identify the image(s) of 8.

2. Explain what is one-to-one, one-to-many, many-to-one and many-to-many relations with examples. Which relations are functions?

3. Given the function $f : x \to \frac{x}{3x+2}$, $x \neq 2$. Find (a) the image of 1 and -2. (b) the object that has -5 as its image. (c) $f^1(1)$. (d) $ff(x)$ (e) $ff^1(x)$ (f) $f^1f(x)$.

4. Given the function $h : x \to |x + 1|$, (a) find the image of -3 and 2. (b) sketch the graph of $h(x) = |x + 1|$ in the domain $\{x : -3 \leq x \leq 2\}$. (c) determine the range of the function.

5. If $f : x \to 2x^2 + 1$ and $g : x \to x + 3$, find gf, fg, gf(1) and $fg(-1)$.

6. It is given that $g : x \to x - 6$. Another function f is such that $gf : x \to 3x + 10$. Find the function f.

7. It is given that $f : x \to x - 1$ and $gf : x \to x^2 - 5x + 8$. Find the function g and f^2g.

F4.2 - Quadratic Equations

1. Rewrite $x(2x + 3) = 3 - 2x$ in the general form of a quadratic equation. Determine if -3 and 2 are roots of the equation. Find all the roots of the equations with (a) factorisation, (b) completing the square and (c) quadratic formula. Proof that the equation has two distinct roots. State the coordinate of minimum point and sketch the graph of $f(x) = 2x^2 + 5x - 3$.

2. Given that m and n are the roots of the equation $2x^2 - 3x - 6 = 0$, form the quadratic equation with roots $\frac{m}{2}$ and $\frac{n}{2}$.

3. Given that $x^2 - 4x = -p$ has real roots, determine the range of values of p.

F4.3 - Quadratic Functions

1. Find the value of q if the graph of $f(x) = x^2 - (q+3)x + 1$ touches the x-axis at only one point.

2. Determine the range of values of k for which the curve $f(x) = 2x^2 - 6x + 5 + k$ intersects the x-axis at two distinct points.

3. Express each of the following quadratic functions in the form $a(x + p)^2 + q$, where a, p and q are constants. Hence, state the minimum/maximum value of the function and corresponding value of x. Sketch the graph. (a) $f(x) = 2x^2 - 3x + 7$ (b) $g(x) = (3 + 2x)(1 - x)$

4. The function $f(x) = x^2 - 4x + p$ has a minimum value of -9. Find the value of p.

5. The function $g(x) = p + qx - 3x^2$ has a maximum value of $\frac{16}{3}$ when $x = \frac{1}{3}$.
   Find the value of p and q.

6. Find the value of p for which the equation $x^2 + 2px - 2x = 11 - 3p^2$ does not have real roots.

7. The straight line $y = 2x + k$ intersects the curve $x^2 + y^2 = 20$ at two distinct points. Find the range of values of k.

8. Solve the inequality $2x^2 + 9x - 5 < 0$.

9. Show that $g(x) = -2x^2 + 3x - 8$ is negative for all values of x.

F4.4 - Simultaneous Equations

1. Solve the equations $3x + 2y = x^2 + y^2 = 5$.

2. The sum of two numbers is 7 and the sum of their squares is 85. Determine the numbers.

3. Find the points of intersection between the straight line $2x = 5y - 17$ and the curve $x = \frac{6}{y}$

F4.5 - Indices and Logarithms

1. Evaluate $12^{\frac{1}{3}} \times 18^{-\frac{2}{3}}$ and $\log_{16} 4$.

2. Show that $2^{n+1} + 2^{n+2} - 4(2^{n-2})$ can be divided exactly by 5 for all positive integer values of n.

3. Show that $\log_5 p + \log_p 256 + 4 = \frac{(2 + \log_5 p)^2}{\log_5 p}$

4. Solve the following equations:
   a. $2^x = 256$ *b.* $4^x = 7$
   c. $2\log_x 5 + \log_x 4 = 2$
   d. $\log_{10}(2x+1) = \log_{10} 3 + \log_{10}(x-5)$
   e. $\log_2 x - \log_4 3 = 0$
   f. $3^{2x} - 12(3^x) + 27 = 0$
   g. $\log_4[\log_3(5x+1)] = \frac{1}{2}$
   h. $\log_{\sqrt{2}}[\log_{\sqrt{2}}(\log_{\sqrt{2}} x^2)] = 2$

5. If $\log_2 x = m$ and $\log_2 y = n$, express $\log_2 \frac{x}{2y}$ in terms of m and n.

F4.6 - Coordinate Geometry

1. Show that the triangle *PQR* is an isosceles triangle given *P*(4,6), *Q*(1,2) and *R*(7,10).

2. Find the coordinates of the midpoints of the line segments joining A(5, -7) and B(-3, -1).

3. Find the coordinates of the point P that divides the line segment joining M(4, -3) and N(4, 4) in the ratio 2:5

4. Find the area of the triangle with vertices A(2, 5) , B(-1, -3) and C(3, -2).

5. Find the area of the polygon with the vertices (-2, -5), (3, 6), (8, -4) and (-4, 2).

6. Given that the points A(8, 3), B(b, 5) and C(-2,8) are collinear, find the value of b.

7. Find the equation of a straight line L1 that passes through the point (-1, 5) and has a gradient 2. Find another equation of a straight line L2 that passes through (2, 3) and parallel to L1. Find another equation of a straight line L3 that passes through (-2, 0) and perpendicular to L1.

8. Find the equation, in general form, of the perpendicular bisector of the straight line joining P(3, -2) and Q(-1, 7).

9. Find the equation of the locus of the point P that moves such that it is always equidistant from two fixed points, Q(-1, 3) and R(2, -4).

10. Point P moves such that PA:PB = 3:2 where A and B are the fixed points (1, -2) and (4, 5) respectively. Find the equation of the locus P.

F4.7 - Statistics

1. Find the mean, mode, median, range, variance and standard deviation for the set of data:
   (a) 8, 7, 12, 14, 12, 16.
   (b)

Score	0	1	2	3	4	5
Frequency	4	6	5	8	6	1

2. Given that the mean of number 5, 8, *x*, 9 and 12 is 8. Find the value of *x* and state the median.

3. Find the modal class, mode, mean, median, 1st quartile, 3rd quartile, interquartile, range, variance and standard deviation:

Weight of newspaper	11 - 20	21 - 30	31 - 40	41 - 50	51 – 60
No. of students	6	10	8	4	2

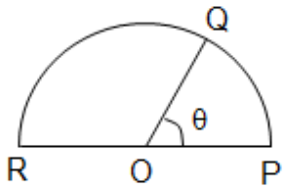
4. Draw a histogram and an ogive for the set of data in question no. 3. From the histogram, find the mode of the data. From the ogive, find median, 1st quartile and 3rd quartile.

F4.8 - Circular Measure

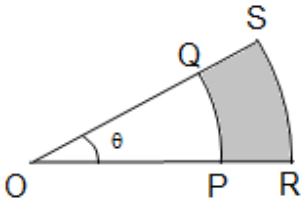
1. Convert 0.36π rad to degrees.

2. Convert 30° to radians.

3. In the diagram, PQR is a semicircle with centre O. If PQ:QR = 2:3, find θ in radian.



4. PQ and RS are the arcs of two circles with a common centre O. If OP = 10cm, PR = 4cm and the perimeter of the shaded region is 26cm, find θ in radian. Then, find
   a. length of arc PQ and RS
   b. the area of the shaded region.



F4.9 - Differentiation

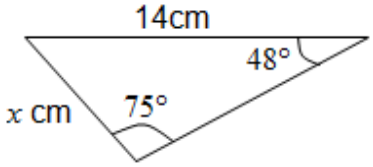
1. Find $\underset{n\to 2}{Limit}\,(3n-1)$
2. Find $\underset{n\to 0}{Limit}\,\dfrac{3n^2-5n}{n}$
3. Find $\underset{n\to \infty}{Limit}\,\dfrac{10}{n-3}$
4. If $y=4x(5x-1)^2$, find $\dfrac{dy}{dx}$
5. if $y=\dfrac{x^2-1}{\sqrt{2x-1}}$, find $\dfrac{dy}{dx}$
6. Find the turning point for $y = x^2 - 4x + 1$ and determine whether the turning point is a maximum or a minimum point.

7. The side of a cube increases with a rate of 0.2cms^{-1}. Find the rate of increase of the volume when its side is 8cm. Volume of cube, $v = x^3$, x = side.

8. Find the small change in the area of a circle when its radius increases from 7cm to 7.5cm

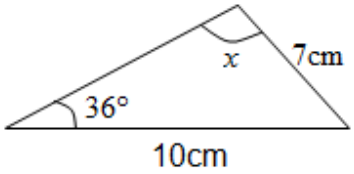
F4.10 - Solution of Triangles

1. Find the value of x in the triangle below:



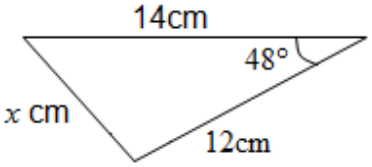
Then find the area of the triangle.

2. Find the angle x in the triangle below:



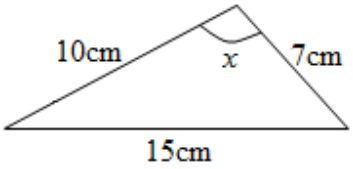
Then find the area of the triangle.

3. Find the value of x in the triangle below:



Then find the area of the triangle.

4. Find the angle x in the triangle below:



Then find the area of the triangle.

F4.11 – Index Number

1. The prices of a pair of shoes in 2003 and 2004 are RM80 and RM96 respectively. Calculate the index in 2004 given that 2003 is the base year.

2. The index numbers of a computer in 1995 and 2001 based on the year 1992 are 120 and 150 respectively. If the price of the computer in 2001 was RM4200, find
   a. the price index of the computer in 2001 based on the year 1995.
   b. the prices of the computer in 1992 and 1995.

3. The table shows the price indices and the weightages of four things in 1997 based on the year 1992. Find the composite index of 1997. Then find the price of a pair of shoes in 1997 if its price in 1992 is RM60.

Things	Price Index	Weightage
Shirt	120	2
Trousers	105	8
Bag	140	4
Shoes	150	6

4. Table shows the price indices of three items: J, K, L and the corresponding weightages. The prices of K were RM16 and RM19.20 in 1997 and 2000 respectively. Calculate the value of x. If the composite index is 114.5, calculate the value of y.

Items	Price Index (Base year 1997)	Weightage
J	80	4
K	x	$16 - y$
L	125	y