Mathematics 3201
June 2016 Public Exam Outcome Report

This examination follows the specifications, conventions and standards set out in the:
Mathematics Public Examination Standards

Chapters:
1 Set Theory
2 Counting Method
3 Probability
4 Rational Expressions and Equations
5 Polynomial Functions
6 Exponential Functions
7 Logarithmic Functions
8 Sinusoidal Functions
9 Financial Mathematics: Borrowing Money

PART I: Selected Response—Total Value: 50%

Item	Curriculum Guide Pages	Outcome	Cognitive Level	Outcome Description
1	22	LR2	2M	Given two events A and B, which are not mutually exclusive, $n(U)$, and a Venn diagram with $n(A \setminus B)$, $n(B \setminus A)$, $n(A \cap B)$ and $n(A \cup B)'$, find $n(A)$.
2	26	LR2	2M	Given a Venn diagram with two non-disjoint (intersecting) sets, determine the number of elements in the complement of the intersection of the sets.
3	28	LR2	2A	Given two finite sets, each described using set notation, determine the number of elements in the intersection of the sets.
4	30	LR2	2A	Given two events A and B which are not mutually exclusive and $n(A)$, $n(B)$, $n(A \cap B)$, and $n(A \cup B)'$, find $n(U)$ where *U* denotes the universal set.
5	52	P4	2M	Given multiple distinct elements in each of four categories, determine the total number of choices possible if one element is selected from each category.
6	58	P5	2M	Determine the number of different ways in which *n* distinct objects can be arranged.

7	56 & 64	P4	2M	Determine the number of personal identification numbers (PIN's) that can be created using the digits 0 to 9, given the number of digits in the PIN, that repetition of digits is permitted, and that there is a restriction on the digit used for the first number of the PIN.
8	60	P5	2A	Simplify an algebraic fraction containing a factorial in the numerator and a factorial in the denominator.
9	68	P5	2A	Determine the number of distinct arrangements of a set if items, when some of the items are repeated.
10	70	P6	2A	Given the number of males and the number of females in a class, identify the expression that indicates the number of ways in which a committee with *n* members can be selected if the committee must include at least *n* - 2 females.
11	92	P3	2M	Identify events that are dependent.
12	82	P1	2M	Given the probability of an event as a percent, determine the odds in favour of the event as a ratio.
13	88	P2	2A	Given a Venn diagram containing $n(A \setminus B), n(B \setminus A), n(A \cap B),$ and $n(A \cup B)'$, determine the probability (as a percentage) that a randomly selected element is in $(A \setminus B) \cup (B \setminus A)$.
14	94	P3	2A	Given a deck containing n cards divided into 4 equal, different-coloured sets, determine the probability that the first card is a given colour and the second card is the same colour as the first or any two other colours, if the cards are drawn without replacement.
15	82,94	P1,P3	L3	Given two dependent events *X* and *Y*, $P(X)$, $P(Y)$, and $P(X \cap Y)$, find $P(Y \mid X)$.
16	100	RF1	2M	Identify the rational expression (in factored form) that has the given non-permissible values.
17	104	RF1	2M	Determine the simplified form of a rational expression that is given in factored form.
18	104	RF1	2A	Determine the simplified form of a rational expression that is not in factored form. The numerator is a linear binomial and the denominator is a quadratic binomial with no linear term.
19	106	RF2	2A	Simplify the quotient of two rational expressions with like numeric denominators, and monomials of different degree in the numerators.

20	108	RF2	2A	Simplify the sum of a numerical fraction and an algebraic rational expression with a linear monomial in its numerator and a linear binomial in its denominator.
21	110	RF3	2A	Solve an equation equating two algebraic rational expressions with numeric numerators. There is a monic quadratic binomial with no constant term in one of the denominators and a linear monomial in the other.
22	120	RF7	2M	Given the graph of a polynomial function, identify the range of the function.
23	120	RF7	2M	Identify the graph that represents a polynomial function.
24	122	RF7	2A	Given a polynomial function and its graph, identify which characteristic of the function and/or graph will change if the sign of the leading coefficient is changed.
25	120	RF7	2A	Given a polynomial function classified according to its degree, identify the maximum number of turning points and the number of *x*-intercepts of the function.
26	124	RF7	2A	Given the graph of a polynomial function, identify the degree and the sign of the leading coefficient of the function.
27	126	RF7	2A	Identify the equation (in factored form) which corresponds to the given end behaviour and *y*-intercept of the graph of the function.
28	140	RF6	2M	Given the type of exponential function and the *y* -intercept of the corresponding graph, identify the corresponding function written in the form $f(x)=a(b)^x$.
29	142	RF6	2M	Given the graph of an exponential function, identify the corresponding equation written in the form $y=a(b)^x$.
30	146	RF5	2A	Solve an exponential equation equating powers in which the bases can be made equal. The base of one power is a natural number raised to a linear binomial exponent. The base of the other power is a numeric fraction with a linear binomial exponent.
31	150	RF5	2A	Given an equation has the form $G(t)=a(b)^{ct+d}$ (*a, b, c*, and *d* are constants), which models population growth, determine the amount of time required for the population to reach a given value.
32	150	RF5	2A	Given a table of data modelling exponential growth, identify the correct description of the initial amount and of the rate of growth.

33	152	RF6	2A	Given the principal invested, the annual interest rate, the compounding period, and the term of the investment, identify the exponential equation that represents the value of the investment at the end of the term.
34	170	RF4	2M	Identify the logarithmic equation that is equivalent to the given exponential equation.
35	168	RF6	2M	Given a logarithmic graph, identify the corresponding logarithmic equation.
36	170	RF4	2A	Evaluate a numeric logarithmic expression of the form $\log_b\left(\frac{1}{N}\right)$, where *N* is a power of *b*.
37	174	RF4	2A	Rewrite a logarithmic expression of the form $a\log_b c - \log_b d$ (*a*, *b*, *c*, and *d* are constants) as a single logarithm.
38	176	RF5	2A	Given the logarithmic equation $\beta = 10(\log I + 12)$ and the intensity of a sound in watts per square meter, determine the sound level in decibels.
39	174	RF4	L3	Determine the expanded form of a logarithmic expression in which the argument is a rational expression raised to an exponent.
40	194	RF8	2M	Given the graph of a sinusoidal function, identify the period of the graph.
41	196	RF8	2M	Given a sinusoidal function in the form $f(x) = a\cos b(x-c)+d$ (*a*, *b*, *c*, and *d* are constants), determine the equation of the midline of the graph of the function.
42	190	RF8	2A	Convert an angle measure from degrees to radians.
43	194	RF8	2A	Given the graph of a sinusoidal function, determine if the graph is a sine curve or a cosine curve and identify how the base graph has been translated.
44	198	RF8	2A	Given the equation $y = a\sin b(x-c)+d$, determine the value of *b* that will result in a graph with a given period.
45	200	RF8	2A	Given the midline equation of a sinusoidal graph and the minimum value of the corresponding sinusoidal function, determine the maximum value of the function.
46	210	F1	2M	Given a partial amortization table showing the payment period, the loan payment amount for each payment period, the amount of the principal repaid for each payment period, and the loan balance after each payment period, determine the amount of a given payment that is interest.
47	210	F1	2M	Determine which combination of annual interest rate and compounding frequency will yield the greatest return on an investment.

48	212	F1	2M	Given the principal invested (*P*), the annual interest rate (*r*) as a percent, the investment period in years, and the corresponding investment equation in the form $A = P\left(1 + \frac{r}{k}\right)^n$, identify the interest compounding period.
49	210	F1	2A	Given the loan principal, the annual interest rate as a percent, the compounding frequency, and the loan term in years, determine total amount to be repaid at the end of the term if the loan is to be repaid in one lump sum.
50	224	F2	2A	Given the number of days that a person intends to ski in one season, determine the least expensive option by comparing the cost of renting per day versus purchasing ski equipment and by comparing the cost of purchasing a daily versus a seasonal ski pass.

PART II: Constructed Response—Total Value: 50%

Item	Curriculum Guide Page	Outcome	Cognitive Level	Value	Outcome Description
51	24	LR2	L2A	3	Given three non-disjoint (intersecting) sets, $n(U), n(A), n(B), n(C), n(B \cap C \setminus A), n(A \cap C \setminus B), n(A \cap B \cap C),$ and $n(A \cup B \cup C)'$, use the provided Venn diagram to algebraically find the number of the elements in $n(A \cap B \setminus C)$.
52a	60	P5	L2A	3	Algebraically solve an equation involving factorial expressions. One side of the equation consists of an algebraic fraction with a numerator that is the product of a constant and a monic, linear binomial factorial and a denominator that is a monic linear monomial factorial. The other side of the equation is a constant.
52b	70	P5, P6	L2A	2	Determine the number of codes that can be created using a range of digits, given the number of digits in the code, that repetition of digits is not permitted, and that there is a restriction on the digits used for the first and for the last number of the code.

52c	70	P5, P6	L2A	1	Given the number of people who have job experience and the number of people without job experience, determine the number of ways in which an employer can hire only those with job experience.
53a	80,150	P1, RF5	L3	2	Given the exponential function of the form $A(t) = a(b)^t$ (*a* and *b* are constants) modelling the value of money initially invested at the beginning of the year, determine the probability that the value of the investment is greater than a given value if the money can only be withdrawn at the end of a subsequent year.
53b	84	P6	L3	4	Given the number of teachers, the number of male students, the number of female students, and the size of a committee, determine the probability that the committee consists of an equal number of male and female students if there must be at least one teacher on the committee.
54a	112	RF3	L2A	4	Solve a given rational equation in which one side of the equation consists of the difference of a monic linear monomial and a rational expression with a constant numerator and a monic linear binomial denominator, and the other side of the equation consists of a rational expression with monic linear binomials in the numerator and denominator. The denominator in both rational expressions is identical.
54b	112	RF3	L3	2	Given the time taken for three individuals to complete a task, create a rational equation that could be used to determine the time taken to complete the task if all three work together.
55a	124	RF7	L2A	4	Given the graph of a polynomial function, identify four properties of the graph and/or the corresponding equation.
55b	126	RF7	L3	2	Given a polynomial function and a description of four characteristics of the function/graph, two of which are incorrect, identify the two errors and explain the corrections.
56a	142	RF5	L2A	4	Solve an exponential equation in which the bases can be made equal. One side of the equation consists of a radical with a monic linear monomial exponent and the other side of the equation consists of a numerical fraction with a monic linear binomial exponent.

56b	150	RF5	L3	3	Given the exponential function of the form $P(t) = a(b)^{ct}$ (*a*, *b,* and *c* are constants) that models a population growth problem, algebraically determine the time taken for the population to reach a given number.
57a	178	RF5	L2A	4	Solve an exponential equation in which the bases cannot be made equal.
57b	180	RF4	L3	3	Given an exponential decay function of the form $A(t) = a(b)^{\frac{t}{c}}$ (*b* is not 0.5), and the corresponding decay graph, algebraically determine the half-life of the substance.
58(i)	200	RF8	L2A	1	Given a sinusoidal function of the form $h(t) = a\sin bt + d$ (*b* is in degrees), which models the height of a revolving object, determine the height of the axis of rotation above the ground.
58(ii)	200	RF8	L2A	1	Given a sinusoidal function of the form $h(t) = a\sin bt + d$ (*b* is in degrees), which models the height of a revolving object, determine the maximum of the revolving object.
58(iii)	200	RF8	L2A	1	Given a sinusoidal function of the form $h(t) = a\sin bt + d$ (*b* is in degrees), which models the height of a revolving object, determine the time taken for one revolution.
58(iv)	200	RF8	L2A	1	Given a sinusoidal function of the form $h(t) = a\sin bt + d$ (*b* is in degrees), which models the height of a revolving object, determine the height of the revolving object above the ground at a given time.
58(v)	200	RF8	L3	2	Given a sinusoidal function of the form $h(t) = a\sin bt + d$ (*b* is in degrees), which models the height of a revolving object, determine the height of the revolving object above the ground when the position of the axis of revolution is changed.
59	210	F1	L2A	3	Determine the amount of interest charged on a loan that is repaid with a single payment at the end of the term, given the loan principal, the annual interest rate, the interest compounding frequency, and the term of the loan.