

# Mathematics for Work and Everyday Life, Grade 11

Workplace Preparation

MEL3E

This course enables students to broaden their understanding of mathematics as it is applied in the workplace and daily life. Students will solve problems associated with earning money, paying taxes, and making purchases; apply calculations of simple and compound interest in saving, investing, and borrowing; and calculate the costs of transportation and travel in a variety of situations. Students will consolidate their mathematical skills as they solve problems and communicate their thinking.

**Prerequisite:** Principles of Mathematics, Grade 9, Academic, or Foundations of Mathematics, Grade 9, Applied, or a ministry-approved locally developed Grade 10 mathematics course

## MATHEMATICAL PROCESS EXPECTATIONS

The mathematical processes are to be integrated into student learning in all areas of this course.

Throughout this course, students will:

- Problem Solving**
  - develop, select, apply, compare, and adapt a variety of problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;
- Reasoning and Proving**
  - develop and apply reasoning skills (e.g., use of inductive reasoning, deductive reasoning, and counter-examples; construction of proofs) to make mathematical conjectures, assess conjectures, and justify conclusions, and plan and construct organized mathematical arguments;
  - demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem (e.g., by assessing the effectiveness of strategies and processes used, by proposing alternative approaches, by judging the reasonableness of results, by verifying solutions);
- Reflecting**
- Selecting Tools and Computational Strategies**
  - select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;
- Connecting**
  - make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts (e.g., other curriculum areas, daily life, current events, art and culture, sports);
- Representing**
  - create a variety of representations of mathematical ideas (e.g., numeric, geometric, algebraic, graphical, pictorial representations; onscreen dynamic representations), connect and compare them, and select and apply the appropriate representations to solve problems;
- Communicating**
  - communicate mathematical thinking orally, visually, and in writing, using precise mathematical vocabulary and a variety of appropriate representations, and observing mathematical conventions.

# A. EARNING AND PURCHASING

## OVERALL EXPECTATIONS

By the end of this course, students will:

1. interpret information about different types of remuneration, and solve problems and make decisions involving different remuneration methods;
2. demonstrate an understanding of payroll deductions and their impact on purchasing power;
3. demonstrate an understanding of the factors and methods involved in making and justifying informed purchasing decisions.

## SPECIFIC EXPECTATIONS

### 1. Earning

By the end of this course, students will:

- 1.1 gather, interpret, and compare information about the components of total earnings (e.g., salary, benefits, vacation pay, profit-sharing) in different occupations
- 1.2 gather, interpret, and describe information about different remuneration methods (e.g., hourly rate, overtime rate, job or project rate, commission, salary, gratuities) and remuneration schedules (e.g., weekly, biweekly, semi-monthly, monthly)
- 1.3 describe the effects of different remuneration methods and schedules on decisions related to personal spending habits (e.g., the timing of a major purchase, the scheduling of mortgage payments and other bill payments)
- 1.4 solve problems, using technology (e.g., calculator, spreadsheet), and make decisions involving different remuneration methods and schedules

**Sample problem:** Two sales positions are available in sportswear stores. One pays an hourly rate of \$11.25 for 40 h per week. The other pays a weekly salary of \$375 for the same number of hours, plus a commission of 5% of sales. Under what conditions would each position be the better choice?

### 2. Describing Purchasing Power

By the end of this course, students will:

- 2.1 gather, interpret, and describe information about government payroll deductions (i.e., CPP, EI, income tax) and other payroll deductions (e.g., contributions to pension plans other than CPP; union dues; charitable donations; benefit-plan contributions)
- 2.2 estimate and compare, using current secondary data (e.g., federal tax tables), the percent of total earnings deducted through government payroll deductions for various benchmarks (e.g., \$15 000, \$20 000, \$25 000)
 

**Sample problem:** Compare the percentage of total earnings deducted through government payroll deductions for total earnings of \$15 000 and \$45 000.
- 2.3 describe the relationship between gross pay, net pay, and payroll deductions (i.e., net pay is gross pay less government payroll deductions and any other payroll deductions), and estimate net pay in various situations
- 2.4 describe and compare the purchasing power and living standards associated with relevant occupations of interest

### 3. Purchasing

By the end of this course, students will:

- 3.1** identify and describe various incentives in making purchasing decisions (e.g., 20% off;  $\frac{1}{3}$  off; buy 3 get 1 free; loyalty rewards; coupons; 0% financing)
- 3.2** estimate the sale price before taxes when making a purchase (e.g., estimate 25% off of \$38.99 as 25% or  $\frac{1}{4}$  off of \$40, giving a discount of about \$10 and a sale price of approximately \$30; alternatively, estimate the same sale price as about  $\frac{3}{4}$  of \$40)
- 3.3** describe and compare a variety of strategies for estimating sales tax (e.g., estimate the sales tax on most purchases in Ontario by estimating 10% of the purchase price and adding about a third of this estimate, rather than estimating the PST and GST separately), and use a chosen strategy to estimate the after-tax cost of common items

*Sample problem:* You purchase three items for \$8.99 each and one item for \$4.99. Estimate the after-tax total.

- 3.4** calculate discounts, sale prices, and after-tax costs, using technology
- 3.5** identify forms of taxation built into the cost of an item or service (e.g., gasoline tax, tire tax)
- 3.6** estimate the change from an amount offered to pay a charge
- Sample problem:* Estimate the change from the \$20 offered to pay a charge of \$13.87.
- 3.7** make the correct change from an amount offered to pay a charge, using currency manipulatives

*Sample problem:* Use currency manipulatives to explain why someone might offer \$15.02, rather than \$15.00, to pay a charge of \$13.87.

- 3.8** compare the unit prices of related items to help determine the best buy
- Sample problem:* Investigate whether or not purchasing larger quantities always results in a lower unit price.
- 3.9** describe and compare, for different types of transactions, the extra costs that may be associated with making purchases (e.g., interest costs, exchange rates, shipping and handling costs, customs duty, insurance)

*Sample problem:* What are the various costs included in the final total for purchasing a digital audio player online from an American source? Using an online calculator, calculate the final cost, and describe how it compares with the cost of the purchase from a major retailer in Ontario.

- 3.10** make and justify a decision regarding the purchase of an item, using various criteria (e.g., extra costs, such as shipping costs and transaction fees; quality and quantity of the item; shelf life of the item; method of purchase, such as online versus local) under various circumstances (e.g., not having access to a vehicle; living in a remote community; having limited storage space)

*Sample problem:* I have to take 100 mL of a liquid vitamin supplement every morning. I can buy a 100 mL size for \$6.50 or a 500 mL size for \$25.00. If the supplement keeps in the refrigerator for only 72 h, investigate which size is the better buy. Explain your reasoning.

## B. SAVING, INVESTING, AND BORROWING

### OVERALL EXPECTATIONS

By the end of this course, students will:

1. describe and compare services available from financial institutions;
2. demonstrate an understanding of simple and compound interest, and solve problems involving related applications;
3. interpret information about different ways of borrowing and their associated costs, and make and justify informed borrowing decisions.

### SPECIFIC EXPECTATIONS

#### 1. Comparing Financial Services

By the end of this course, students will:

- 1.1 gather, interpret, and compare information about the various savings alternatives commonly available from financial institutions (e.g., savings and chequing accounts, term investments), the related costs (e.g., cost of cheques, monthly statement fees, early withdrawal penalties), and possible ways of reducing the costs (e.g., maintaining a minimum balance in a savings account; paying a monthly flat fee for a package of services)
- 1.2 gather, interpret, and compare information about the costs (e.g., user fees, annual fees, service charges, interest charges on overdue balances) and incentives (e.g., loyalty rewards; philanthropic incentives, such as support for Olympic athletes or a Red Cross disaster relief fund) associated with various credit cards and debit cards
- 1.3 read and interpret transaction codes and entries from various financial statements (e.g., bank statement, credit card statement, passbook, automated banking machine printout, online banking statement, account activity report), and explain ways of using the information to manage personal finances

*Sample problem:* Examine a credit card statement and a bank statement for one individual, and comment on the individual's financial situation.

#### 2. Saving and Investing

By the end of this course, students will:

- 2.1 determine, through investigation using technology (e.g., calculator, spreadsheet), the effect on simple interest of changes in the principal, interest rate, or time, and solve problems involving applications of simple interest
- 2.2 determine, through investigation using technology, the compound interest for a given investment, using repeated calculations of simple interest for no more than 6 compounding periods  
*Sample problem:* Someone deposits \$5000 at 4% interest per annum, compounded semi-annually. How much interest accumulates in 3 years?
- 2.3 describe the relationship between simple interest and compound interest in various ways (i.e., orally, in writing, using tables and graphs)

**2.4** determine, through investigation using technology (e.g., a TVM Solver on a graphing calculator or on a website), the effect on the future value of a compound interest investment of changing the total length of time, the interest rate, or the compounding period

**Sample problem:** Compare the results at age 40 of making a deposit of \$1000 at age 20 or a deposit of \$2000 at age 30, if both investments pay 6% interest per annum, compounded monthly.

**2.5** solve problems, using technology, that involve applications of compound interest to saving and investing

### 3. Borrowing

By the end of this course, students will:

**3.1** gather, interpret, and compare information about the effects of carrying an outstanding balance on a credit card at current interest rates

**Sample problem:** Describe ways of minimizing the cost of carrying an outstanding balance on a credit card.

**3.2** gather, interpret, and compare information describing the features (e.g., interest rates, flexibility) and conditions (e.g., eligibility, required collateral) of various personal loans (e.g., student loan, car loan, “no interest” deferred-payment loan, loan to consolidate debt, loan drawn on a line of credit, payday or bridging loan)

**3.3** calculate, using technology (e.g., calculator, spreadsheet), the total interest paid over the life of a personal loan, given the principal, the length of the loan, and the periodic payments, and use the calculations to justify the choice of a personal loan

**3.4** determine, using a variety of tools (e.g., spreadsheet template, online amortization tables), the effect of the length of time taken to repay a loan on the principal and interest components of a personal loan repayment

**3.5** compare, using a variety of tools (e.g., spreadsheet template, online amortization tables), the effects of various payment periods (e.g., monthly, biweekly) on the length of time taken to repay a loan and on the total interest paid

**3.6** gather and interpret information about credit ratings, and describe the factors used to determine credit ratings and the consequences of a good or bad rating

**3.7** make and justify a decision to borrow, using various criteria (e.g., income, cost of borrowing, availability of an item, need for an item) under various circumstances (e.g., having a large existing debt, wanting to pursue an education or training opportunity, needing transportation to a new job, wanting to set up a business)

# C. TRANSPORTATION AND TRAVEL

## OVERALL EXPECTATIONS

By the end of this course, students will:

1. interpret information about owning and operating a vehicle, and solve problems involving the associated costs;
2. plan and justify a route for a trip by automobile, and solve problems involving the associated costs;
3. interpret information about different modes of transportation, and solve related problems.

## SPECIFIC EXPECTATIONS

### 1. Owning and Operating a Vehicle

By the end of this course, students will:

- 1.1 gather and interpret information about the procedures (e.g., in the graduated licensing system) and costs (e.g., driver training; licensing fees) involved in obtaining an Ontario driver's licence, and the privileges and restrictions associated with having a driver's licence
- 1.2 gather and describe information about the procedures involved in buying or leasing a new vehicle or buying a used vehicle
- 1.3 gather and interpret information about the procedures and costs involved in insuring a vehicle (e.g., car, motorcycle, snowmobile) and the factors affecting insurance rates (e.g., gender, age, driving record, model of vehicle, use of vehicle), and compare the insurance costs for different categories of drivers and for different vehicles  
*Sample problem:* Use automobile insurance websites to investigate the degree to which the type of car and the age and gender of the driver affect insurance rates.
- 1.4 gather and interpret information about the costs (e.g., monthly payments, insurance, depreciation, maintenance, miscellaneous expenses) of purchasing or leasing a new vehicle or purchasing a used vehicle, and describe the conditions that favour each alternative

*Sample problem:* Compare the costs of buying a new car, leasing the same car, and buying an older model of the same car.

- 1.5 describe ways of failing to operate a vehicle responsibly (e.g., lack of maintenance, careless driving) and possible financial and non-financial consequences (e.g., legal costs, fines, higher insurance rates, demerit points, loss of driving privileges)
- 1.6 identify and describe costs (e.g., gas consumption, depreciation, insurance, maintenance) and benefits (e.g., convenience, increased profit) of owning and operating a vehicle for business  
*Sample problem:* Your employer pays 35 cents/km for you to use your car for work. Discuss how you would determine whether or not this is fair compensation.
- 1.7 solve problems, using technology (e.g., calculator, spreadsheet), that involve the fixed costs (e.g., licence fee, insurance) and variable costs (e.g., maintenance, fuel) of owning and operating a vehicle  
*Sample problem:* The rate at which a car consumes gasoline depends on the speed of the car. Use a given graph of gasoline consumption, in litres per 100 km, versus speed, in kilometres per hour, to determine how much gasoline is used to drive 500 km at speeds of 80 km/h, 100 km/h, and 120 km/h. Use the current price of gasoline to calculate the cost of driving 500 km at each of these speeds.

## 2. Travelling by Automobile

By the end of this course, students will:

- 2.1** determine distances represented on maps (e.g., provincial road map, local street map, Web-based maps), using given scales

*Sample problem:* Compare the driving distances between two points on the same map by two different routes.

- 2.2** plan and justify, orally or in writing, a route for a trip by automobile on the basis of a variety of factors (e.g., distances involved, the purpose of the trip, the time of year, the time of day, probable road conditions, personal priorities)

- 2.3** report, orally or in writing, on the estimated costs (e.g., gasoline, accommodation, food, entertainment, tolls, car rental) involved in a trip by automobile, using information from available sources (e.g., automobile association travel books, travel guides, the Internet)

- 2.4** solve problems involving the cost of travelling by automobile for personal or business purposes

*Sample problem:* Determine and justify a cost-effective delivery route for ten deliveries to be made in a given area over two days.

*Sample problem:* Discuss the impact if 100 students decided to walk the 3-km distance to school instead of taking a school bus.

- 3.2** gather, interpret, and compare information about the costs (e.g., insurance, extra charges based on distance travelled) and conditions (e.g., one-way or return, drop-off time and location, age of the driver, required type of driver's licence) involved in renting a car, truck, or trailer, and use the information to justify a choice of rental vehicle

*Sample problem:* You want to rent a trailer or a truck to help you move to a new apartment. Investigate the costs and describe the conditions that favour each option.

- 3.3** gather, interpret, and describe information regarding routes, schedules, and fares for travel by airplane, train, or bus

- 3.4** solve problems involving the comparison of information concerning transportation by airplane, train, bus, and automobile in terms of various factors (e.g., cost, time, convenience)

*Sample problem:* Investigate the cost of shipping a computer from Thunder Bay to Windsor by airplane, train, or bus. Describe the conditions that favour each alternative.

## 3. Comparing Modes of Transportation

By the end of this course, students will:

- 3.1** gather, interpret, and describe information about the impact (e.g., monetary, health, environmental) of daily travel (e.g., to work and/or school), using available means (e.g., car, taxi, motorcycle, public transportation, bicycle, walking)