CHAPTER

1

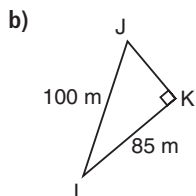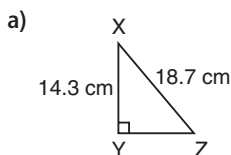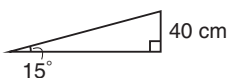**1.** Which angle in each triangle can be calculated using the cosine ratio? Explain your choice. Use the ratio to determine the angle measure.

a)
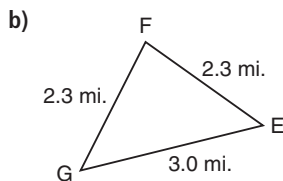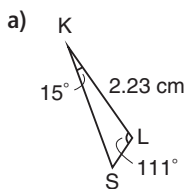
X

14.3 cm   18.7 cm

Y   Z

b)

J

100 m   ◇K

85 m

L

2. A metal cutter uses this scale drawing to cut a triangular sheet of metal. What are the lengths of the two unmarked sides?
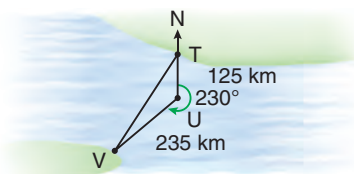
40 cm

15°

3. The measure of $\angle P$ is between 0° and 180°. Determine all possible values of $\angle P$.

a) $\sin P = 0.35$ **b)** $\sin P = 0.41$
c) $\cos P = -0.92$ **d)** $\tan P = -0.87$

4. Solve each triangle.

a)

K

15°   2.23 cm

L

S   111°

b)

F

2.3 mi.   2.3 mi.

E

G   3.0 mi.

5. A cruise ship leaves dock T and sails south 125 km. Then it travels 235 km on a bearing of 230° to island V. What is the distance from the island to the dock?
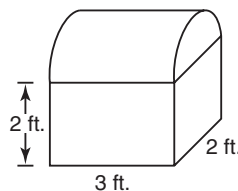
N

T

125 km

230°

U

235 km

V

2

6. Jean-Pierre creates this stencil out of plastic. What is the area of the plastic? The inner design is an equilateral triangle, inside a larger equilateral triangle, inside a square. The side length of each shape is given.

8.7 cm

15.0 cm

23.0 cm
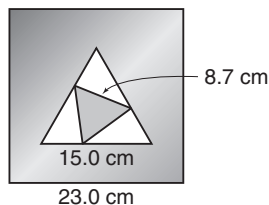
7. Sharon is painting the outside of this toy box. What is the surface area that she will paint?

2 ft.

2 ft.

3 ft.

8. Ryan uses 48 interlocking foam tiles to create a rectangular play area along one side of a toy shop wall. Each tile is a square with side length 1 foot. He will tape the edges away from the wall to the floor. What is the minimum length of tape he will need?

9. Geneviève is constructing a rectangular prism with surface area exactly 294 m². It will have the greatest possible volume.
a) Describe the prism. What will be its dimensions?
b) What will be its volume?

10. What are the dimensions of the cylinder with volume 282 cubic inches and the least surface area?

3 **11.** State whether each situation involves one-variable data or two-variable data.
  a) Kaleigh heard that more people are born in August than in any other month. She would like to check this.
  b) A team of scientists in Antarctica concluded that there is a connection between atmospheric carbon dioxide levels and global temperatures.

12. As an incentive for travellers to purchase their tickets early, airlines offer discounts on seats that are booked far in advance of the departure date. This table shows the cost of an airline ticket over time.

Weeks remaining before departure	Price of economy class seat ($)
8	154
7	154
6	193
5	240
4	315
3	489

  a) Create a scatter plot for the data. Include time values up to 11 weeks before departure.
  b) Draw a line of best fit.
  c) Use the line of best fit to predict the cost of a ticket purchased 10 weeks before to departure. Do you think the prediction is reasonable? Why or why not?
  d) Are you satisfied with the way your line of best fit represents the data? Why or why not?

4 **13.** A new stop sign is put up in a neighbourhood of about 200 houses. A resident wants to determine what her neighbours think about the sign. Which of the sampling techniques described below is most appropriate? Justify your choice.
 i) She decides to sample 25% of the houses in the neighbourhood. She randomly selects a house to start at and then goes to every fourth house and asks her survey question.
  ii) She stands for an hour in the morning and an hour in the evening at the intersection that has the new stop sign. When people stop, she asks them her survey question.
  iii) She takes a page out of the city phone book and calls every 10th name to ask her survey question.

14. The 2006 UBS *Prices and Earnings* report includes a comparison of net wages in 71 cities. The base wage is the wage in New York. This graph shows data for 10 cities.

Net Wages Around the World
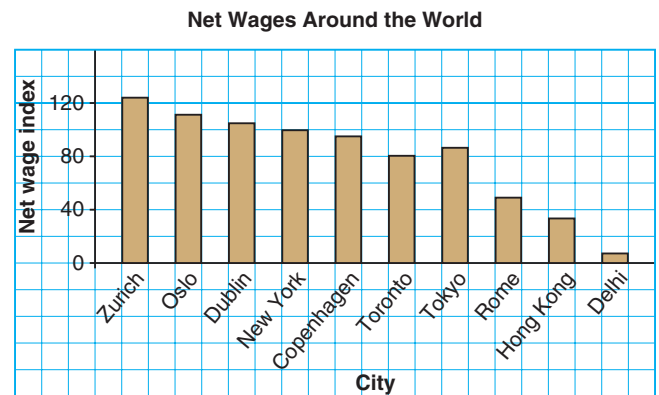
  a) In which cities are net wages greater than those in New York? Justify your answer.
  b) In which cities are net wages less than those in New York? Justify your answer.

15. The graph shows the growth of a fruit fly population over 50 days under controlled laboratory conditions.

Fruit Fly Population Growth
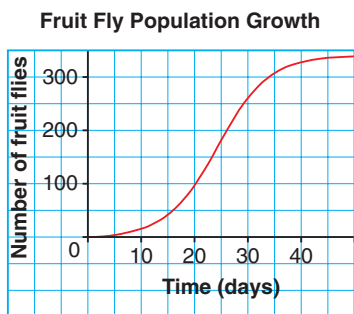
a) Describe the trends in the graph.

b) Estimate the average rate of change in the fruit fly population from day 25 to day 30. Explain the units of the rate of change. What does the rate of change tell you about the fruit fly population?

c) Determine the rate of change in the fruit fly population from day 45 to day 50. Did you have to calculate the rate of change? Explain.

16. The formula $A = P(1 + i)^n$ can be used to model the growth of money when the interest is compounded annually. In the formula, P dollars is the principal invested, i is the annual rate of interest as a decimal, and A dollars is the amount of the investment after n years. Which relation, quadratic, linear, or exponential, results under each condition?

a) $P = 100$ and $i = 0.06$

b) $P = 100$ and $n = 2$

c) $i = 0.08$ and $n = 1$

Justify your answers.

17. The table gives the world population between 1986 and 1991.

Year	1986	1987	1988	1989	1990	1991
Population (billions)	4.936	5.023	5.111	5.201	5.329	5.422

a) Calculate the rate of change in the world population from 1986 to 1991. Interpret the meaning of the rate of change.

b) Which model, linear, quadratic, or exponential, do you think best fits the data? Justify your answer.

c) Determine the equation of the regression model you chose in part a.

d) Use the model to predict the world population in 2007. What factors may affect the reliability of your prediction? Explain.

18. A child's wading pool and a bucket used to fill the pool are shown. How many buckets of water are needed to fill the pool to a height of 15 cm? Justify the formulas used.
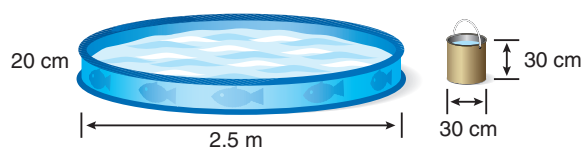
19. The formula $S = 180(n - 2)$ gives the sum, S, of the interior angles of a polygon with n sides.

a) Rearrange the formula to solve for n. Use an arrow diagram to justify your choice of inverse operations.

b) The sum of the interior angles of a polygon is 720°. How many sides does the polygon have?

6 **20.** Evaluate without a calculator.

a) $3^{-6} \times 3^4$

b) $\left(\dfrac{2}{3}\right)^4$

c) $\dfrac{(2^2)^3}{2^0}$

d) $\dfrac{3^{-2} \times 5^3}{3^2 \times 5}$

e) $144^{\frac{1}{2}}$

f) $(-64)^{\frac{2}{3}}$

21. Simplify and evaluate for $a = 2$, $b = -4$, and $c = 3$.

a) $(2a)^b$

b) $\dfrac{a^3 b^2 c^{-1}}{a^{-1} b^0 c^{-1}}$

22. Solve for x. Explain your strategy. How do you know your answers are correct?

a) $x^3 = 27$ b) $2^x = 8$

c) $4^x = 25$ d) $27^{2x+1} = 9$

e) $x^{\frac{3}{2}} = 64$ f) $100(1.02)^x = 250$

23. The formula $i = \left(\dfrac{A}{P}\right)^{\frac{1}{n}} - 1$ gives the annual interest rate, i, required for a principal, P dollars, to grow to an amount, A dollars, in n years when the interest is compounded annually. Determine the interest rate required for an investment of $500 to grow to $629.86 in 3 years.

24. The population, P wolves, in a conservation area can be modelled by the equation $P = 80(1.02)^t$, where t is the number of years since 2000.

a) Predict the wolf population in 2010.

b) What is the doubling time for the population?

Justify your answers.

7 **25.** Dominic works after school to save money for college. He makes monthly deposits of $250 into an account that earns 4% per year, compounded monthly. What is the amount of these deposits after 5 years?

26. Jenny wins a lottery. Starting one month from now, she will receive $1000 a month for life.

a) What is the present value of the lottery payments if Jenny lives another 40 years? Assume that money can be invested at 8% per year, compounded monthly.

b) Would the present value in part a double if the monthly payments were $2000 instead of $1000? Explain.

27. Suppose you want to have $1 000 000 in a retirement account when you turn 65.

a) How much would you need to deposit at the end of each week to accumulate this amount if money can be invested at a rate equivalent to 10% per year, compounded weekly?

b) How much of the $1 000 000 comes from your weekly deposits? How much is interest?

28. a) Determine the regular quarterly payment on a $10 000 loan to be repaid over 5 years at 14% per year, compounded quarterly.

b) Hillary thinks that if the quarterly payment is doubled, it will take half as long to repay the loan. Is she correct? Justify your answer.

7 **29.** The Shahs arrange a $200 000 mortgage at 6% per year, compounded semi-annually for 25 years.

    a) Calculate the monthly payment and the total interest paid over the life of the mortgage.

    b) How much interest would the Shahs have saved if they had arranged a 20-year mortgage?

    c) What else could the Shahs do to reduce the interest they will pay over the life of the mortgage? Why will these reduce the interest costs?

    d) Suppose the Shahs had chosen to make accelerated bi-weekly payments instead of monthly payments. How long would it have taken them to repay the mortgage? How much interest would they have saved?

30. Use a spreadsheet to create an amortization table for the Shahs' 25-year mortgage in question 29.

    a) How much interest and principal is paid in the first 6 payments?

    b) How much do the Shahs still owe at the end of 5 years?

8 **31.** Faris listed his housing costs. Calculate his total housing cost for one year.

Description	Frequency	Estimated cost ($)
Rent	monthly	825.00
Content insurance	monthly	20.00
Cable/Internet/ phone	monthly	124.00
Utilities	bi-monthly	220.00

32. Eiko rents an apartment on a month-to-month lease. She decides to move to a different apartment at the end of the month. Her landlord tells her she must pay rent for the following month or find another tenant to replace her. Is her landlord correct?

33. Jeremy plans to work on a cruise ship for a year to save money for college. He will earn $1500 per month as an ordinary seaman. His accommodations and food are free. He expects to spend about $100 a month on personal expenses, $10 every 2 weeks on laundry, and $150 a week on entertainment.

    a) Design a monthly budget using the data provided. Show your calculations.

    b) How much money does Jeremy expect to save each month?

    c) The tuition cost of the one-year college program Jeremy is interested in is $3300. How much money will he have left over to cover his housing and living expenses while he is in school? Would you recommend he also get a part-time job? Explain.

34. Maral is moving to St. Catharines to start a new job. Her annual net income will be $33 000. Maral has $10 000 in savings. She estimates her monthly expenses, not including housing, will be $1400.

Option 1: Buying a 1-bedroom condo
Down payment of $8 000
Bi-weekly mortgage payments of $415
Monthly maintenance fees of $220

Option 2: Renting a 1-bedroom apartment
$850 per month, plus utilities
Which housing option would you recommend? Justify your answer.