Grade 11
Essential Math 30S
Final Exam
January 2018

Don't forget to put your calculator into DEGREES

Show all calculations. Money should have 2 decimals. Rounding counts.
<table>
<thead>
<tr>
<th>Learning Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest</td>
<td>15</td>
</tr>
<tr>
<td>Credit</td>
<td>16</td>
</tr>
<tr>
<td>Managing Money</td>
<td>12</td>
</tr>
<tr>
<td>Trigonometry</td>
<td>18</td>
</tr>
<tr>
<td>Surface Area</td>
<td>15</td>
</tr>
<tr>
<td>Volume</td>
<td>16</td>
</tr>
<tr>
<td>Slope and Rate of Change</td>
<td>15</td>
</tr>
<tr>
<td>Graphical Representations</td>
<td>11</td>
</tr>
<tr>
<td>Self-Reflection</td>
<td>2</td>
</tr>
<tr>
<td>Total Marks</td>
<td>120</td>
</tr>
</tbody>
</table>

**General Directions:**

- You may use your 8 ½ by 11 study sheet.
- You should have a formula sheet on your desk.
- Make sure your calculator is set to degrees.
- Show your calculations if the question is worth more than 1 mark!
- Make sure your devices are OFF and in your backpack or at home or maybe crushed and thrown in a landfill somewhere.
Interest

1. You deposit $200 in the bank for 7 months. The interest rate is 2.35%. Find the simple interest earned. (2 marks)

\[
I = 200 \times 0.0235 \times \frac{7}{12}
\]

\[
= $2.74
\]

2. You deposit $2000 in the bank for 4 years. The interest rate is 1.95%, compounded monthly. Calculate the balance in your bank account at the end of the 4 years (assuming you let it compound). (3 marks)

\[
A = 2000 \left(1 + \frac{0.0195}{12}\right)^{48}
\]

\[
= $2162.11
\]
3. What percent interest per year could you expect to get if you put your money into a savings account at the Access Credit Union in Altona today?

(1 mark)

\[ \frac{1}{6} \text{ or } 2.30\% \text{ platinum savings} \]

4. How much money would you need in savings to earn $1000 per month just from the interest? Assume you can get 2.20% interest per year. (2 marks)

\[ P = \frac{1000}{0.022 \times \frac{1}{12}} = \$545454.55 \]

5. State one advantage and one disadvantage of a term deposit. (2 marks)

adv - higher rate

dis - locked in
6. A friend said they put $4000 in the bank and 5 years later had earned $550 in interest. Calculate the interest rate with two decimals. (2 marks)

\[ r = \frac{550}{4000 \times 5} \times 100 \]

\[ = 2.75\% \]

7. Your grandma puts a loonie ($1) in the bank the day you are born. On your 18th birthday she gives you the money with interest. Grandma put the money in an account that compounds interest daily. The interest rate was 2.5%. Calculate the total you will receive on your 18th birthday. (3 marks)

\[ A = P \left(1 + \frac{r}{n}\right)^{nt} \]

\[ P = 1 \]
\[ r = 0.025 \]
\[ n = 365 \]
\[ t = 18 \]
\[ n \times t = 6570 \]

\[ A = 1 \left(1 + \frac{0.025}{365}\right)^{6570} \]

\[ = 1.57 \]
Credit

8. Rennie wants to borrow $3500 to buy a used car. His local credit union is offering him an interest rate of 4.75%.

<table>
<thead>
<tr>
<th>Annual Rate</th>
<th>1 Year Monthly</th>
<th>2 Years Monthly</th>
<th>3 Years Monthly</th>
<th>4 Years Monthly</th>
<th>5 Years Monthly</th>
<th>6 Years Monthly</th>
<th>7 Years Monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75%</td>
<td>$85.49</td>
<td>$43.76</td>
<td>$29.86</td>
<td>$22.92</td>
<td>$18.76</td>
<td>$15.99</td>
<td>$14.02</td>
</tr>
<tr>
<td>5.00%</td>
<td>$85.61</td>
<td>$43.87</td>
<td>$29.97</td>
<td>$23.03</td>
<td>$18.87</td>
<td>$16.10</td>
<td>$14.13</td>
</tr>
<tr>
<td>5.25%</td>
<td>$85.72</td>
<td>$43.98</td>
<td>$30.08</td>
<td>$23.14</td>
<td>$18.99</td>
<td>$16.22</td>
<td>$14.25</td>
</tr>
<tr>
<td>5.50%</td>
<td>$85.84</td>
<td>$44.10</td>
<td>$30.20</td>
<td>$23.26</td>
<td>$19.10</td>
<td>$16.34</td>
<td>$14.37</td>
</tr>
</tbody>
</table>

a) Calculate Rennie’s monthly loan payment if he takes out a 2-year loan. (2 marks)

\[
\frac{3500 \times 43.76}{1000} = \$153.16
\]

b) Calculate the total interest that Rennie pays over the life of his loan. (2 marks)

\[
153.16 \times 24 = 3675.84
\]

\[
\frac{3500 - 175.84}{175.84} = \frac{-5-}{4}\
\]
9. Rennie decides to lengthen the term of his loan from 2 years to \textbf{5 years}. The interest rate will stay the same at 4.75%.

a) What \textbf{effect} does lengthening the term of his loan have on Rennie's monthly payment? (1 mark)

\[ \text{lowers it} \]

b) What \textbf{effect} does lengthening the term of his loan have on the total interest paid over the life of the loan? (1 mark)

\[ \text{increases it} \]
10. Mary's monthly credit card statement has a previous balance of $2031.02. Mary made a payment of $800 during the month. She also made several more purchases totaling $749.39. The credit card company also charged Mary $34.77 interest.

a) Calculate Mary's new credit card balance. (2 marks)

\[
2031.02 - 800 + 749.39 + 34.77 = 2015.18
\]

b) Calculate Mary's minimum monthly payment if it is 5% of her balance or $15, whichever is greater. (1 mark)

\[
2015.18 \times 0.05 = 100.76
\]
11. You are purchasing a hot tub from Hot Time Tubs and have two payment options: Cash or Installment Plan. The hot tub you want has a sticker price of $4299.99.

a) Calculate the price of the hot tub if you paid cash. Assume 8% PST and 5% GST must be added to the sticker price. (2 marks)

\[ 4299.99 \times 1.13 = \]$4858.99

b) Calculate the total paid if you choose the installment plan. (2 marks)

<table>
<thead>
<tr>
<th>Hot Time Tubs – Installment Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no money down and no taxes at all!)</td>
</tr>
<tr>
<td>Money Down</td>
</tr>
<tr>
<td>$0.00</td>
</tr>
</tbody>
</table>

\[ 149.99 \times 48 = \]$7199.52
12. Payday loan companies charges a fee of $20 per $100 borrowed. Borrowers must pay the loan plus the fee back in 2 weeks. Calculate the rate of interest a payday loan company is charging. (3 marks)

\[
r = \frac{20}{100} \times \frac{2}{52} \times 100 = 520\% /0
\]
Managing Money

14. Morley keeps track of his grocery spending for 3 months as follows:

October - $299.80  November - $304.12  December - $283.40

Morley should enter the following number into his budget spreadsheet for his average grocery expenses: Circle the BEST response. (1 mark)

a) $300.00  b) $295.77  c) $887.32  d) $304.12

15. Morley’s net pay is $1290 per month. He is told that he should spend 25% of his income on food.

a) Calculate how much money Morley should spend on food every month. (1 mark)

\[
1290 \times 0.25 = 322.50
\]

b) How can Morley reduce his food expense? Give a reasonable piece of advice. (1 mark)

look for sales
buy a freezer.
16. Conrad earns $32,500 every year before deductions.

a) What is Conrad’s monthly gross pay? (1 mark)

\[ 32500 \div 12 = \$2708.33 \]

b) Conrad’s deductions are 27% of his gross pay. Calculate his monthly deduction amount. (1 mark)

\[ 2708.33 \times 0.27 = \$731.25 \]

c) Calculate Conrad’s monthly net pay. (1 mark)

\[ 2708.33 - 731.25 = \$1977.08 \]
17. Daisy is preparing a budget for herself. Her net pay is $340.50 every week. Calculate the monthly income amount Daisy should use when preparing her budget. (2 marks)

\[
\frac{340.50 \times 52}{12} = \$1475.50
\]

18. Don works 5 days a week. Don works every week of the year except for two weeks in July when he takes holidays. Every day, Don buys a can of Red Bull on his way to work.

If a can of Red Bull is $3.85, how much money could Don save in a year if he quit drinking Red Bull and just brought a water bottle from home? (2 marks)

\[
50 \times 5 = 250 \\
\times 3.85 \\
\overbrace{962.50}^{\text{3 marks}}
\]
19. After completing a "living on your own" project, what expenses surprised you the most? Explain. (1 mark)

20. What advice can you give someone that would prepare them for unexpected expenses such as an unplanned visit to the dentist? (1 mark)
21. A tree casts a shadow that is 300 feet long. The angle of elevation to the top of the tree is 34°. How tall is the tree? (3 marks)

\[
\tan 34 = \frac{\text{opp}}{300}
\]

\[
\text{opp} = 202.35 \text{ ft}
\]
22. A hiker is 48 feet away from a tree and measures the angle of elevation to its peak to be 38°. He measures the angle of elevation to its base to be 6°. Calculate the height of the tree. (5 marks)

\[ \tan 6 = \frac{\text{opp}}{48} \]

\[ \text{opp} = 5.045 \]

\[ \tan 38 = \frac{\text{opp}}{48} \]

\[ \text{opp} = 37.502 \]

Tree is 42.55 ft tall.
23. From the top of a 60 foot building, the angle of elevation to the top of a second taller building is \(42^\circ\). The angle of depression to the bottom of the taller building is \(23^\circ\). How tall is the second building? (5 marks)

\[
\tan 23 = \frac{60}{\text{adj}} \quad \tan 42 = \frac{\text{opp}}{141.35}
\]

(2) \(\text{opp} = 127.27\)

height is 127.27

\[
+60
\]

\[
187.27 \text{ ft.}
\]
24. A radio station tower was built in two sections. From a point 200 feet from the base of the tower, the angle of elevation of the top of the first section is 26°, and the angle of elevation of the top of the second section is 42°. To the nearest foot, what is the height of the top section of the tower (x)?

(5 marks)

\[ \tan 26^\circ = \frac{\text{opp}}{200} \]
\[ \text{opp} = 97.55 \text{ ft} \]

\[ \tan 42^\circ = \frac{\text{opp}}{200} \]
\[ \text{opp} = 180.08 \text{ ft} \]

\[ x = 180.08 - 97.55 \]
\[ = 82.53 \text{ ft} \]
Surface Area

25. A 3-D sketch of a cylinder is shown below:

a) Draw a net of the cylinder and label the dimensions necessary to calculate the surface area. (3 marks)

![Diagram of a cylinder with dimensions labeled]

b) Calculate the surface area of the cylinder. (3 marks)

\[ A = \pi \times 3.1^2 \times 2 + 19.48 \times 12.2 \]

\[ = 66.38 + 237.66 \]

\[ = 298.04 \text{ mm}^2 \]
26. A 3-D sketch of a triangular prism is shown below:

a) Draw a net of the prism and label the dimensions necessary to calculate the surface area. (3 marks)

\[ a = \sqrt{7^2 - 3.5^2} = 6.06 \text{ cm} \]

b) Calculate the surface area of the prism. (3 marks)

\[ 7 \times 12 \times 3 + \frac{7 \times 6.1 \times 2}{2} = 294.7 \text{ cm}^2 \]

No rounding ok.
27. Marvin is attaching siding to the outside of his granddaughter's dollhouse. The dollhouse is 36 inches long by 18 inches wide. The walls are 20 inches high. The gable ends are 4 inches high at the center. All four walls and both gable ends need siding. Ignore the windows and doors in your calculations.

a) Calculate the total surface area to which Marvin must attach siding. (3 marks)

\[20 \times 36 \times 2 + 20 \times 18 \times 2 + \frac{4 \times 18 \times 2}{2}\]

\[= 2232 \text{ in}^2\]

b) Dollhouse siding comes in one square foot pieces (1 ft²). How many pieces of siding does Marvin need to buy? Show your calculations. (3 marks)

\[2232 \div 144 = 15.5 \approx 16\] pieces.
Volume

28. A candy store has a peanut bin that is 48 inches long, 24 inches wide, and 36 inches tall. The bin is a rectangular prism.

a) Calculate the volume of the bin in cubic inches. (2 marks)

\[ 48 \times 24 \times 36 = 41,472 \text{ in}^3 \]

b) Calculate the volume of the bin in cubic feet. (2 marks)

\[ 41,472 \div 12^3 = 24 \text{ ft}^3 \]

c) Calculate the volume of the bin in cubic yards. (2 marks)

\[ 24 \div 3^3 = 0.89 \text{ yd}^3 \]
29. A chef wants to fill his cooking pot with chicken broth. The pot has a diameter of 18 inches and a depth of 7 inches.

![Diagram of the pot with measurements converted to centimeters]

a) Convert the measurements of the pot to centimeters. (1 in = 2.54 cm)

Label the pot with the correct metric dimensions. (1 mark)

\[18 \times 2.54 = 45.72 \text{ cm}\]
\[7 \times 2.54 = 17.78 \text{ cm}\]

b) Calculate the volume of the pot. (3 marks)

\[V = \pi r^2 \times h\]
\[= \pi \times 22.86^2 \times 17.78 = 29190.00 \text{ cm}^3\]

3

c) How many litres of water will the pot hold? (1 mark)

\[29190 \div 1000 = 29.19 \text{ L}\]
30. A dirt biker wants to build a dirt ramp on their practice track.

   a) Calculate the volume of dirt needed in cubic meters to make the ramp. *(3 marks)*

   \[
   V = \frac{5 \times 4 \times 1}{2} \\
   = \frac{0.8 \times 3.4 \times 2.8}{2} = 3.808 \text{ m}^3 \\
   = 3.81 \text{ m}^3
   \]

   b) Convert your answer above to cubic yards. *(2 marks)*

   \[
   3.808 \times 1.09361^3 \\
   = 4.98 \text{ yd}^3
   \]
Slope and Rate of Change

31. A 10.8 km section of highway increases 426 m in elevation.

a) Calculate the slope of the highway to three decimal places. (2 marks)

\[
\frac{426}{10800} = 0.0394
\]

\[
0.039
\]

b) Calculate the angle of elevation to one decimal place. (2 marks)

\[
\theta = \tan^{-1}\left(\frac{426}{10800}\right) = 2.26^\circ
\]

\[
2.3^\circ
\]

c) Calculate the percent grade to one decimal place. (2 marks)

\[
\frac{426}{10800} \times 100 = 3.94\%
\]

\[
3.9\%
\]
32. Len is installing a support wire on his grandmother’s clothesline pole. The wire needs to be anchored 31 ft from the base of the pole. The wire must be attached to the pole at a height of 19 ft.

a) What is the angle of elevation of the support wire to the ground? (2 marks)

\[ \theta = \tan^{-1}\left(\frac{19}{31}\right) = 31.50^\circ \]

b) What is the slope of the guy wire? Express in two ways. (2 marks)

\[ \frac{19}{31} \times 100 = 61.29\% \]

\[ \frac{19}{31} = \frac{x}{12} \quad \text{so about} \quad \frac{7}{12} \]
33. You are driving in the Pembina Hills and notice a sign that says "Hill ahead". Because you are a mathematician, you wonder what pitch a 25% grade is. Calculate the equivalent pitch for 25% and then indicate which roof pitch is closest to the grade. (2 marks)

\[
\frac{25}{100} = \frac{x}{12} = \frac{3}{12} \text{ pitch}
\]

The roof pitch closest to the grade is 7/12.
34. You are in Chicago and want to take a taxi from your hotel to a museum across town. The taxi pulls up and you notice the sign on the side:

![TAXI FARE]

Calculate the cost of a ride that is 3 miles long, including a stop for 5 minutes at a Tim Horton's. The ride occurred at 7 pm in the evening.

Note: a surcharge is an extra charge added to something. (4 marks)

\[
2.50 + 3 \times (0.40 \times 5) + (5 \times 0.40) + 1.00 \\
2.50 + 6.00 + 2.00 + 1.00 \\
= \$11.50
\]
Graphical Representations

35. The histogram below shows the scores of grade 12 students on their provincial exam.

a) How many students scored in the range of 80 to 89? (1 mark)

b) How many students wrote the exam? (1 mark)

c) What percent of the class scored 90 or higher? (2 marks)
36. John collects hockey cards. He recently surveyed people at the mall and recorded the number of cards collected on the histogram shown below:

![Histogram showing the number of cards collected]

a) How many people surveyed had over 20 hockey cards? (1 mark)

b) How many people were surveyed in total? (1 mark)

c) What percent of the people surveyed owned more than 30 hockey cards? (2 marks)
37. Lacey has a net monthly income of $1352.00. A breakdown of her monthly expenses is shown in the following circle graph.

![Monthly Expenses Diagram](image)

**Monthly Expenses**

- Savings: 4%
- Entertainment: 3%
- Charitable donations: 6%
- Miscellaneous: 20%
- Car: 13%
- Food: 16%
- Housing: 38%

a) How much does Lacey spend on food each month? How did that compare to your calculations on the moving out project? (2 marks)

\[
(1) \quad 1352 \times 0.20 = 270.40
\]

(1) compare

b) How much does Lacey spend on housing each month? How did that compare to your calculations on the moving out project? (2 marks)

\[
(1) \quad 1352 \times 0.38 = 513.76
\]

(1) compare