FINAL EXAMINATION
DAWSON COLLEGE
201-171 - Mathematical Models
Tuesday December 16th (14:00 - 17:00)

LAST NAME:_____

FIRST NAME:_____

STUDENT NUMBER:_____

INSTRUCTIONS

1- **SHOW ALL YOUR WORK** or you will lose marks.
2- The exam is marked out of **75 points**.
3- The exam has **14 questions.**
4- A **FORMULA SHEET** is attached to the exam.
5- Any type of calculator is permitted.
6- **Blank sheets** are provided at the end of the exam.

Question 1. *(5 marks)*
Use your calculator to find the value of the following expression:

$$\frac{1}{80}\left(\sqrt[3]{\frac{234\mu-(0.056)^2}{7.8\times10^{-8}\times9.1}}-2.34k\right)$$

Express the answer in **scientific notation and exponential notation (with metric prefixes)**. (Show a few steps to guarantee part marks in the case that you make a mistake).

Question 2. *(5 marks)*
$2^x = 3(5)^x$

Question 3. *(5 marks)*
Solve for x.
$\ln(2x-3)+\ln(3x-2)=\ln(4x+1)$

Question 4. *(5 marks)*

By mass, a certain roadbed material is 75% crushed rock, and a second material is 30% crushed rock. How many tonnes of each must be mixed in order to have 250 tonnes of material with a percentage of crushed rock of 50%? (Optional: Use the table below if it is helpful)

Name of Variable	Unit	Material 1	Material 2	Final Material
Tons of Material				
% of Crushed Rock				
Tons of Crushed Rock				

Question 5. *(6 marks)*

$x + 2y = 4$

$2x - 3z = 8$

$-3y + 4z = -25$

Question 6. *(6 marks)*

If $f(x) = 1 - x^2$, find the following:

(a) $f(-1)$

(b) $f(x+1)$

(c) $\frac{f(x+y)-f(x)}{y}$

(d) $f(x+2) - (f(x)+2)$

Question 7. *(5 marks)*

On a hot summer day, you but a 6-pack of beer. The beer, not having been refrigerated, is 28°C, so you take it home and put it in the refrigerator, whose temperature is 5°C. One hour later, the beer is 18°. How long after putting it in the fridge do you have to wait for it to be 6°?

Question 8. *(5 marks)*
Simplify the fraction.
$$\frac{1-\frac{6}{4x-4}}{\frac{x}{5}-\frac{1}{2}}$$

Question 9. *(6 marks)*
Solve the following trigonometric equation ($0^\circ \leq x < 360^\circ$).
$4\sin^2 x\cos x - 3\cos x = 0$

Question 10. *(5 marks)*
Solve the equation for z, a complex number.
$(4+\sqrt{-9})(2-j)z-(7+\sqrt{-4})z=(4+8j)$

Question 11. *(5 marks)* Solve the quadratic equation for z, a complex number.
$z^2-(10+4j)z+(30+20j)=0$

Question 12. *(6 marks)*
Express $\sqrt{-3-4j}$ in exponential, polar and rectangular form.

Question 13. *(6 marks)*

Simplify to a single fraction, with positive exponents only and no brackets remaining.

(a) $\left((2a^{-3})(3b^{-2})\right)^{-1}$

(b) $\left((2a^{-3})+(3b^{-2})\right)^{-1}$

Question 14. *(5 marks)* The quadratic equation $y = -x^2 + 12x$ represents the position y in meters x seconds after a ball is kicked. Sketch the graph of this quadratic equation, indicating vertex, x and y intercepts. Use the graph to determine the maximum height of the ball.