Introduction To Engineering – Assignment 02

#	Student ID	Student Name	Grade (10)
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Delivery Date	

١. يتم تسليم التمرين محلولا في خلال أسبوع من تاريخ التمرين، و يتم حذف درجتين من التمرين عن كل أسبوع تأخير
٢. يتم التسليم لمعيد المقرر مباشرة
٣. تتم أجابه التمرين في نفس ورق الأسئلة

Q1

In the triangle shown $a = 5$ in., $b = 7$ in., and $\gamma = 25°$. Define a, b, and γ as variables, and then:

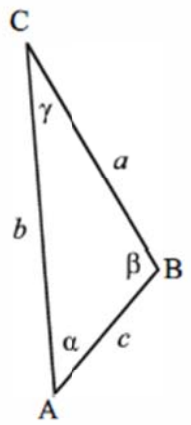
(*a*) Calculate the length of c by substituting the variables in the Law of Cosines.

(Law of Cosines: $c^2 = a^2 + b^2 - 2ab\cos\gamma$)

(*b*) Calculate the angles α and β (in degrees) using the Law of Sines.

(*c*) Verify the Law of Tangents by substituting the results from part (*b*) into the right and left sides of the equation.

Law of Tangents: $\dfrac{a-b}{a+b} = \dfrac{\tan\left[\frac{1}{2}(\alpha-\beta)\right]}{\left[\frac{1}{2}(\alpha+\beta)\right]}$



Sol 1

```
clear, clc
a=5; b=7; gamma=25;
disp('Part (a)')
c=sqrt(a^2+b^2-2*a*b*cosd(gamma))
disp('Part (b)')
alpha = asind(a*sind(gamma)/c)
%note that beta is over 90 deg and asind will give
beta = 180 - asind(b*sind(gamma)/c)
disp('Part (c)')
%compare LHS with RHS
LHS=(a-b)/(a+b)
RHS=tand((alpha-beta)/2)/tand((alpha+beta)/2)
```

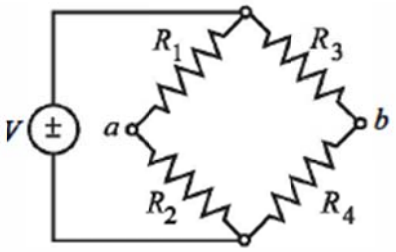
```
Part (a)

c =

    3.2494

Part (b)

alpha =

   40.5647


beta =

  114.4353

Part (c)

LHS =

   -0.1667


RHS =

   -0.1667
```

Q2

The voltage difference V_{ab} between points a and b in the Wheatstone bridge circuit is:

$$V_{ab} = V\left(\frac{R_1R_3 - R_2R_4}{(R_1+R_2)(R_3+R_4)}\right)$$

Calculate the voltage difference when $V = 14$ volts, $R_1 = 120.6$ ohms, $R_2 = 119.3$ ohms, $R_3 = 121.2$ ohms, and $R_4 = 118.8$ ohms.



Sol 2

```
clear, clc
V=14; R1=120.6; R2=119.3; R3=121.2; R4=118.8;
Vab=V*(R1*R3-R2*R4)/((R1+R3)*(R3+R4))
```

```
Vab =

    0.1071

>>
```

Q3	According to special relativity, a rod of length L moving at velocity v will shorten by an amount δ, given by: $$\delta = L\left(1-\sqrt{1-\frac{v^2}{c^2}}\right)$$ where c is the speed of light (about 300×10^6 m/s). Calculate how much a rod 2 m long will contract when traveling at 5,000 m/s.

Sol 3	`clear, clc`
	`L=2; v=5000; c=300*10^6;`
	`delta=L*(1-sqrt(1-v^2/c^2))`
	
	`delta =`
	`2.7778e-010`

Q4	The spread of a computer virus through a computer network can be modeled by: $$N(t) = 20e^{0.15t}$$ where $N(t)$ is the number of computers infected and t time in minutes. (*a*) Determine how long it takes for the number of infected computers to double. (*b*) Determine how long it takes for 1,000,000 computers to be infected.
Sol 4	

```
clear, clc
disp('Part (a)')
t_minutes=log(2)/0.15
disp('Part (b)')
bigt_minutes=log(10^6/20)/0.15
```

```
Part (a)

t_minutes =

    4.6210

Part (b)

bigt_minutes =

   72.1319
```

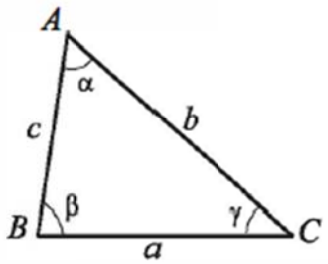
Q5

In the triangle shown $a = 5.3$ in., $\gamma = 42°$, and $b = 6$ in. Define a, γ, and b as variables, and then:

(*a*) Calculate the length b by using the Law of Cosines.
(Law of Cosines: $c^2 = a^2 + b^2 - 2ab\cos\gamma$)

(*b*) Calculate the angles β and γ (in degrees) using the Law of Cosines.

(*c*) Check that the sum of the angles is 180°.



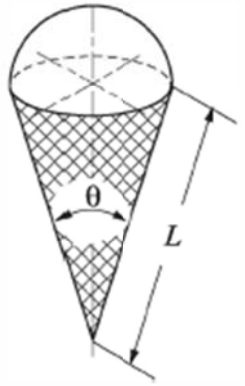
Sol 5

```
clear, clc
a=5.3; gamma=42; b=6;
disp('Part (a)')
c=sqrt(a^2+b^2-2*a*b*cosd(gamma))
disp('Part (b)')
alpha = asind(a*sind(gamma)/c)
beta = asind(b*sind(gamma)/c)
disp('Part (c)')
Total = alpha+beta+gamma
```

```
Part (a)

c =

    4.1019

Part (b)

alpha =

   59.8328


beta =

   78.1672

Part (c)

Total =

   180
```

Q6

In the ice cream cone shown, $L = 4$ in. and $\theta = 35°$. The cone is filled with ice cream such that the portion above the cone is a hemisphere. Determine the volume of the ice cream.



Right Circular Cone $V = \frac{1}{3}\pi r^2 h$

Sphere $V = \frac{4}{3}\pi r^3$

Sol 6

```
clear, clc
L=4; theta=35;
%radius of cone opening and height
r=L*sind(theta/2);
H=L*cosd(theta/2);
%volume of cone + volume of hemisphere
V=pi*r^2*H/3 + 2/3*pi*r^3
```

```
V =

    9.4245
```