(*b*) Calculate *t* for the *B* calculated in part (*a*), from the monthly compounded interest formula, Equation (1).
(*c*) Determine the number of years and months that correspond to *t*.

The problem is solved by writing the following program in a script file:

```
% Solution of Sample Problem 1-4
P=5000;   r=0.085;   ta=17; n=12;
B=P*(1+r)^ta                          Step (a): Calculate B from Eq. (2).
t=log(B/P)/(n*log(1+r/n))             Step (b): Solve Eq. (1)
                                      for t, and calculate t.
years=fix(t)                          Step (c): Determine the number of years.
months=ceil((t-years)*12)             Determine the number of months.
```

When the script file is executed, the following (the values of the variables `B`, `t`, `years`, and `months`) is displayed in the Command Window:

```
>> format short g
B =
        20011
t =
       16.374
years =
    16
months =
     5
```

The values of the variables `B`, `t`, `years`, and `months` are displayed (since a semicolon was not typed at the end of any of the commands that calculate the values).

1.10 PROBLEMS

The following problems can be solved by writing commands in the Command Window, or by writing a program in a script file and then executing the file.

1. Calculate:

(*a*) $\frac{22+5.1^2}{50-6.3^2}$ (*b*) $\frac{44}{7}+\frac{8^2}{5}-\frac{99}{3.9^2}$

2. Calculate:

(*a*) $\frac{\sqrt{41^2-5.2^2}}{e^5-100.53}$ (*b*) $\sqrt[3]{132}+\frac{\ln(500)}{8}$

3. Calculate:

   (*a*) $\dfrac{14.8^3 - 6.3^2}{(\sqrt{13}+5)^2}$ (*b*) $45\left(\dfrac{288}{9.3} - 4.6^2\right) - 1065e^{-1.5}$

4. Calculate:

   (*a*) $\dfrac{24.5 + 64/3.5^2 + 8.3 \cdot 12.5^3}{\sqrt{76.4} - 28/15}$ (*b*) $(5.9^2 - 2.4^2)/3 + \left(\dfrac{\log_{10}12890}{e^{0.3}}\right)^2$

5. Calculate:

   (*a*) $\cos\left(\dfrac{7\pi}{9}\right) + \tan\left(\dfrac{7}{15}\pi\right)\sin(15°)$ (*b*) $\sin^2 80° - \dfrac{(\cos 14° \sin 80°)^2}{\sqrt[3]{0.18}}$

6. Define the variable x as $x = 6.7$, then evaluate:

   (*a*) $0.01x^5 - 1.4x^3 + 80x + 16.7$ (*b*) $\sqrt{x^3 + e^x - 51/x}$

7. Define the variable t as $t = 3.2$, then evaluate:

   (*a*) $56t - 9.81\dfrac{t^2}{2}$ (*b*) $14e^{-0.1t}\sin(2\pi t)$

8. Define the variables x and y as $x = 5.1$ and $y = 4.2$, then evaluate:

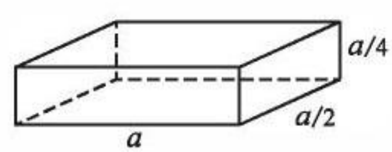
   (*a*) $\dfrac{3}{4}xy - \dfrac{7x}{y^2} + \sqrt{xy}$ (*b*) $(xy)^2 - \dfrac{x+y}{(x-y)|^2} + \sqrt{\dfrac{x+y}{2x-y}}$

9. Define the variables a, b, c, and d as:

   $a = 12$, $b = 5.6$, $c = \dfrac{3a}{b^2}$, and $d = \dfrac{(a-b)^c}{c}$, then evaluate:

   (*a*) $\dfrac{a}{b} + \dfrac{d-c}{d+c} - (d-b)^2$ (*b*) $e^{\frac{d-c}{a-2b}} + \ln\left(\left|c - d + \dfrac{b}{a}\right|\right)$

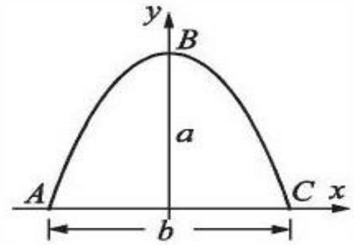
10. A sphere has a radius of 24 cm. A rectangular prism has sides of a, $a/2$, and $a/4$.
    (*a*) Determine a of a prism that has the same volume as the sphere.
    (*b*) Determine a of a prism that has the same surface area as the sphere.



11. The arc length of a segment of a parabola *ABC* of an ellipse with semi-minor axes a and b is given approximately by:

$$L_{ABC} = \frac{1}{2}\sqrt{b^2 + 16a^2} + \frac{b^2}{8a}\ln\left(\frac{4a + \sqrt{b^2 + 16a^2}}{b}\right).$$

(*a*) Determine L_{ABC} if $a = 11$ in. and $b = 9$ in.



12. Two trigonometric identities are given by:

(*a*) $\sin 5x = 5\sin x - 20\sin^3 x + 16\sin^5 x$ (*b*) $\sin^2 x\cos^2 x = \frac{1 - \cos 4x}{8}$

For each part, verify that the identity is correct by calculating the values of the left and right sides of the equation, substituting $x = \frac{\pi}{12}$.

13. Two trigonometric identities are given by:

(*a*) $\tan 3x = \frac{3\tan x - \tan^3 x}{1 - 3\tan^2 x}$ (*b*) $\cos 4x = 8(\cos^4 x - \cos^2 x) + 1$

For each part, verify that the identity is correct by calculating the values of the left and right sides of the equation, substituting $x = 24°$.

14. Define two variables: *alpha* = π/6, and *beta* = 3π/8. Using these variables, show that the following trigonometric identity is correct by calculating the values of the left and right sides of the equation.

$$\sin\alpha + \sin\beta = 2\sin\left(\frac{\alpha + \beta}{2}\right)\cos\left(\frac{\alpha - \beta}{2}\right)$$

15. Given: $\int x\sin ax\,dx = \frac{\sin ax}{a^2} - \frac{x\cos ax}{a}$. Use MATLAB to calculate the following definite integral: $\int_{\frac{\pi}{3}}^{\frac{3\pi}{2}} x\sin(0.6x)dx$.

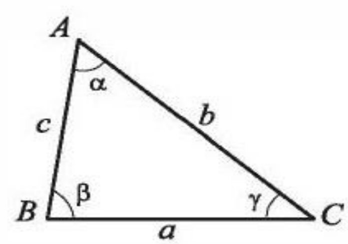
16. In the triangle shown $a = 5.3$ in., $\gamma = 42°$, and $b = 6$ in. Define a, γ, and b as variables, and then:

(*a*) Calculate the length b by using the Law of Cosines.

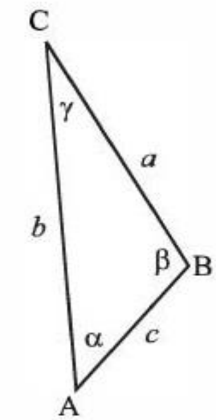
(Law of Cosines: $c^2 = a^2 + b^2 - 2ab\cos\gamma$)

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

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

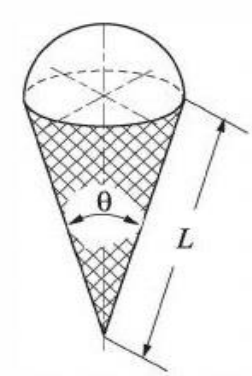


17. In the triangle shown $a = 5$ in., $b = 7$ in., and $\gamma = 25°$. Define a, b, and γ as variables, and then:
   (*a*) Calculate the length of c by substituting the variables in the Law of Cosines.
   (Law of Cosines: $c^2 = a^2 + b^2 - 2ab\cos\gamma$)
   (*b*) Calculate the angles α and β (in degrees) 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.

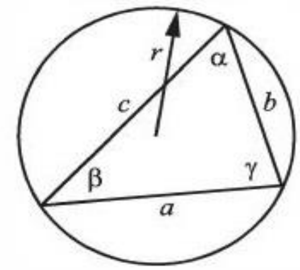


Law of Tangents: $\frac{a-b}{a+b} = \frac{\tan\left[\frac{1}{2}(\alpha-\beta)\right]}{\left[\frac{1}{2}(\alpha+\beta)\right]}$

18. 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.



19. For the triangle shown, $a = 48$ mm, $b = 34$ mm, and $\gamma = 83°$. Define a, b, and γ as variables, and then:
   (*a*) Calculate 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 radius r of the circle circumscribing the triangle using the formula:
   $r = \frac{abc}{4\sqrt{s(s-a)(s-b)(s-c)}}$
   where $s = (a+b+c)/2$.



20. The parametric equations of a line in space are:
   $x = x_0 + at$, $y = y_0 + bt$, and $z = z_0 + ct$. The distance d from a point A (x_A, y_A, z_A) to the line can be calculated by:
   $$d = d_{A0}\sin\left[\operatorname{acos}\left(\frac{(x_A - x_0)a + (y_A - y_0)b + (z_A - z_0)c}{d_{A0}\sqrt{a^2 + b^2 + c^2}}\right)\right]$$
   where $d_{A0} = \sqrt{(x_A - x_0)^2 + (y_A - y_0)^2 + (z_A - z_0)^2}$.
   Determine the distance of the point A $(2, -3, 1)$ from the line $x = -4 + 0.6t$, $y = -2 + 0.5t$, and $z = -3 + 0.7t$. First define the variables x_0, y_0, z_0, a, b, and c, then use the variable (and the coordinates of point A) to calculate the variable d_{A0}, and finally calculate d.