3. If D is the differential operator, then the general solution to $(D + 2)^2 y = 0$ is:

(A) $C_1 e^{-4x}$

(B) $C_1 e^{-2x}$

(C) $e^{-4x}(C_1 + C_2 x)$

(D) $e^{-2x}(C_1 + C_2 x)$

4. A particle traveled in a straight line in such a way that its distance S from a given point on that line after time t was $S = 20t^3 - t^4$. The rate of change of acceleration at time $t = 2$ is:

(A) 72
(B) 144
(C) 192
(D) 208

32. In the figure below, the coefficient of static friction between the block and the inclined plane is 0.25. The block is in equilibrium. As the inclined plane is raised, the block will begin to slide when:

(A) $\sin \phi = 1.0$

(B) $\cos \phi = 1.0$

(C) $\cos \phi = 0.25$

(D) $\tan \phi = 0.25$
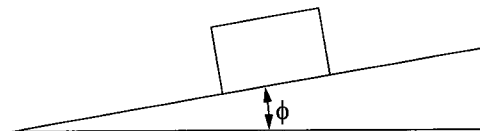
33. A cylinder weighing 120 N rests between two frictionless walls as shown in the figure below. The wall reaction (N) at Point A is most nearly:
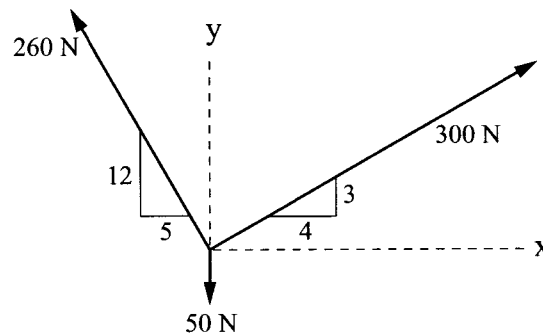
(A)   96
(B)   139
(C)   150
(D)   200
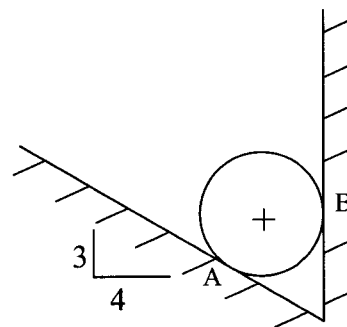
34. Three forces act as shown below. The magnitude of the resultant of the three forces (N) is most nearly:

(A)   140
(B)   191
(C)   370
(D)   396

35. In the figure below, Block A weighs 50 N, Block B weighs 80 N, and Block C weighs 100 N. The coefficient of friction at all surfaces is 0.30. The maximum force **F** (N) that can be applied to Block B without disturbing equilibrium is most nearly:

(A)   15
(B)   54
(C)   69
(D)   84
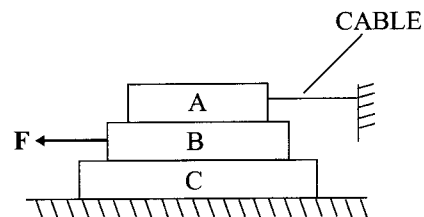
MECHANICAL SAMPLE QUESTIONS

Questions 6–7: An object with a mass m of 1.50 kg moves without friction in a circular path as shown below. Attached to the object is a spring with a spring constant k of 400 N/m. The spring is undeformed when the object is at Point P, and the speed of the object at Point Q is 2.00 m/s.

$k = 400$ N/m

$m = 1.50$ kg

P

Q

125 mm

175 mm
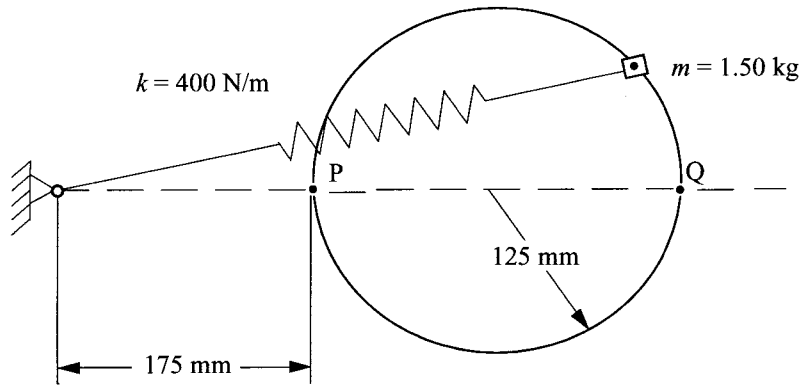
NOT TO SCALE

6. The translational kinetic energy (J) of the object at Point Q is most nearly:
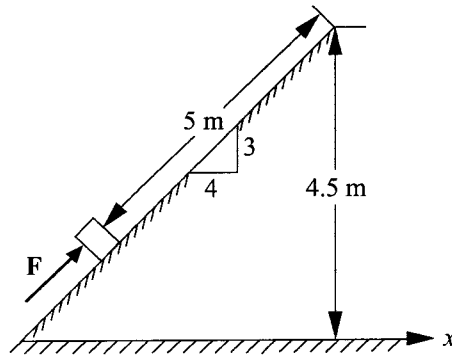
    (A)   1.50
    (B)   3.00
    (C)   6.00
    (D)   29.40

8.

7. The horizontal force (N) of the spring on the object at Point Q is most nearly:

    (A)   100
    (B)   175
    (C)   250
    (D)   400

9.

MECHANICAL SAMPLE QUESTIONS

Questions 8–9: The 2-kg block shown in the figure below is accelerated from rest by force **F** along the smooth incline for 5 m until it clears the top of the ramp at a speed of 8 m/s.

8. The value of **F** (N) is most nearly:

    (A)   11.8
    (B)   19.6
    (C)   24.6
    (D)   69.4

9. The highest elevation h (m) above the x-axis the block will reach is most nearly:

    (A)   1.2
    (B)   3.3
    (C)   5.7
    (D)   7.8