Final exam review questions by Dr. Viv

Instructions: These questions are excerpted from my weekly practice quizzes, with the practice quiz number appearing in square brackets. To effectively study, try them yourself, then check if you got the right answer, by going to the corresponding practice quiz on my course website, look for the answers at the bottom of the page there. Finally, consult the written solutions if you are unsure about your guesses or feel shaky about your correct answer. Happy studying!

1 Suppose $A = B^n C^m$, where A has dimensions LT, B has dimensions $\mathrm{L^2T^{-1}}$, and C has dimensions $\mathrm{LT^2}$. Then the exponents n and m have the values:

A. $2/3;\ 1/3$
B. $2;\ 3$
C. $4/5;\ -1/5$
D. $1/5;\ 3/5$
E. $1/2;\ 1/2$

[PQ01, #5]

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2 A particle moves along the x axis according to the equation $x = 6t^2$, where x is in meters and t is in seconds. Therefore:

A. the acceleration of the particle is 6 $\mathrm{m/s^2}$
B. t cannot be negative
C. the particle follows a parabolic path
D. each second the velocity of the particle changes by 9.8 m/s
E. none of the above

[PQ02, #4]

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3 An object is thrown straight up from ground level with a speed of 50 m/s. If $g = 10\ \mathrm{m/s^2}$ its distance above ground level 1.0 s later is:

A. 40 m
B. 45 m
C. 50 m
D. 55 m
E. 60 m

[PQ02, #5]

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4 A bomber flying in level flight with constant velocity releases a bomb before it is over the target. Neglecting air resistance, which one of the following is NOT true?

A. The bomber is over the target when the bomb strikes
B. The acceleration of the bomb is constant
C. The horizontal velocity of the plane equals the vertical velocity of the bomb when it hits the target
D. The bomb travels in a curved path
E. The time of flight of the bomb is independent of the horizontal speed of the plane

[PQ03, #3]

5 A projectile is fired from ground level over level ground with an initial velocity that has a vertical component of 20 m/s and a horizontal component of 30 m/s. Using $g = 10\,\text{m/s}^2$, the distance from launching to landing points is:

A. 40 m
B. 60 m
C. 80 m
D. 120 m
E. 180 m

[PQ03, #5]

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6 A 25-kg crate is pushed across a frictionless horizontal floor with a force of 20 N, directed 20° below the horizontal. The acceleration of the crate is:

A. $0.27\,\text{m/s}^2$
B. $0.75\,\text{m/s}^2$
C. $0.80\,\text{m/s}^2$
D. $170\,\text{m/s}^2$
E. $470\,\text{m/s}^2$

[PQ04, #1]

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7 You stand on a spring scale on the floor of an elevator. Of the following, the scale shows the highest reading when the elevator:

A. moves downward with increasing speed
B. moves downward with decreasing speed
C. remains stationary
D. moves upward with decreasing speed
E. moves upward at constant speed

[PQ04, #2]

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8 A horizontal force of 5.0 N pushes a 0.50-kg book against a vertical wall. The book is initially at rest. If the coefficients of friction are $\mu_s = 0.6$ and $\mu_k = 0.80$, the magnitude of the frictional force is:

A. 0
B. 4.9 N
C. 3.0 N
D. 5.0 N
E. 4.0 N

[PQ04, #4]

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9 If a certain car, going with speed v_1, rounds a level curve with a radius R_1, it is just on the verge of skidding. If its speed is now doubled, the radius of the tightest curve on the same road that it can round without skidding is:

A. $2R_1$
B. $4R_1$
C. $R_1/2$
D. $R_1/4$
E. R_1

[PQ04, #5]

10 One end of a 1.0-m long string is fixed, the other end is attached to a 2.0-kg stone. The stone swings in a vertical circle, passing the bottom point at 4.0 m/s. The tension force of the string at this point is about:

A. 0
B. 12 N
C. 20 N
D. 32 N
E. 52 N

[PQ05, #1]

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11 A sledge (including load) weighs 5000 N. It is pulled on level snow by a dog team exerting a horizontal force on it. The coefficient of kinetic friction between sledge and snow is 0.05. How much work is done by the dog team pulling the sledge 1000 m at constant speed?

A. 2.5×10^4 J
B. 2.5×10^5 J
C. 5.0×10^5 J
D. 2.5×10^6 J
E. 5.0×10^6 J

[PQ05, #3]

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12 A Boston Red Sox baseball player catches a ball of mass m that is moving toward him with speed v. While bringing the ball to rest, his hand moves back a distance d. Assuming constant deceleration, the horizontal force exerted on the ball by his hand is:

A. mv/d
B. mvd
C. mv^2/d
D. $2mv/d$
E. $mv^2/(2d)$

[PQ05, #4]

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13 An ideal spring is hung vertically from the ceiling. When a 2.0-kg mass hangs at rest from it the spring is extended 6.0 cm from its relaxed length. A downward external force is now applied to the mass to extend the spring an additional 10 cm. While the spring is being extended by the force, the work done by the spring is:

A. -3.6 J
B. -3.3 J
C. -3.4×10^{-5} J
D. 3.3 J
E. 3.6 J

[PQ05, #5]

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14 When a certain rubber band is stretched a distance x, it exerts a restoring force of magnitude $F = Ax$, where A is a constant. The work done by a person in stretching this rubber band from $x = 0$ to $x = L$, beginning and ending at rest, is:

A. AL^2
B. $A + 2L$
C. $A + 2L^2$
D. A/L
E. $AL^2/2$

[PQ06, #3]

15 Only if a force on a particle is conservative:

A. is its work zero when the particle moves exactly once around any closed path
B. is its work always equal to the change in the kinetic energy of the particle
C. does it obey Newton's second law
D. does it obey Newton's third law
E. is it not a frictional force

[PQ06, #4]

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16 A particle moves along the x axis under the influence of a stationary object. The net force on the particle, which is conservative, is given by $F = (8\,\mathrm{N/m^3})x^3$. If the potential energy is taken to be zero for $x = 0$ then the potential energy is given by:

A. $(2\,\mathrm{J/m^4})x^4$
B. $(-2\,\mathrm{J/m^4})x^4$
C. $(24\,\mathrm{J/m^2}x^2$
D. $(-24\,\mathrm{J/m^2})x^2$
E. $5\,\mathrm{J} - (2\,\mathrm{J/m^4})x^4$

[PQ06, #5]

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17 Momentum may be expressed in:

A. kg/m
B. gram·s
C. N·s
D. kg/(m·s)
E. N/s

[PQ07, #2]

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18 A 1.0-kg ball moving at 2.0 m/s perpendicular to a wall rebounds from the wall at 1.5 m/s. The change in the momentum of the ball is:

A. zero
B. 0.5 N · s away from wall
C. 0.5 N · s toward wall
D. 3.5 N · s away from wall
E. 3.5 N · s toward wall

[PQ07, #3]

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19 A 640-N acrobat falls 5.0 m from rest into a net. The net tosses him back up with the same speed he had just before he hit the net. The magnitude of the average upward force exerted on him by the net during this collision is:

A. 32 N
B. 64 N
C. 320 N
D. 640 N
E. impossible to determine from given data

[PQ07, #5]

20 Which one of the following statements is true?

A. the center of mass of an object must lie within the object
B. all the mass of an object is actually concentrated at its center of mass
C. the center of mass of an object cannot move if there is zero net force on the object
D. the center of mass of a cylinder must lie on its axis
E. none of the above

[PQ08, #1]

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21 A 4.0-N puck is traveling at 3.0 m/s. It strikes a 8.0-N puck, which is stationary. The two pucks stick together. Their common final speed is:

A. 1.0 m/s
B. 1.5 m/s
C. 2.0 m/s
D. 2.3 m/s
E. 3.0 m/s

[PQ08, #4]

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22 A 640-N hunter gets a rope around a 3200-N polar bear. They are stationary, 20 m apart, on frictionless level ice. When the hunter pulls the polar bear to him, the polar bear will move:

A. 1.0 m
B. 3.3 m
C. 10 m
D. 12 m
E. 17 m

[PQ09, #1]

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23 A wheel initially has an angular velocity of 36 rad/s but after 6.0 s its angular velocity is 24 rad/s. If its angular acceleration is constant its value is:

A. $2.0\,\mathrm{rad/s^2}$
B. $-2.0\,\mathrm{rad/s^2}$
C. $3.0\,\mathrm{rad/s^2}$
D. $-3.0\,\mathrm{rad/s^2}$
E. $6.0\,\mathrm{rad/s^2}$

[PQ09, #3]

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24 A wheel starts from rest and has an angular acceleration that is given by $\alpha(t) = (6.0\,\mathrm{rad/s^4})t^2$. After it has turned through 10 rev its angular velocity is:

A. 63 rad/s
B. 75 rad/s
C. 89 rad/s
D. 130 rad/s
E. 210 rad/s

[PQ09, #4]

25 A pulley with a radius of 3.0 cm and a rotational inertia of $4.5 \times 10^{-3}\ \text{kg} \cdot \text{m}^2$ is suspended from the ceiling. A rope passes over it with a 2.0-kg block attached to one end and a 4.0-kg block attached to the other. The rope does not slip on the pulley. When the speed of the heavier block is 2.0 m/s the kinetic energy of the pulley is:

A. 0.15 J
B. 0.30 J
C. 1.0 J
D. 10 J
E. 20 J

[PQ09, #5]

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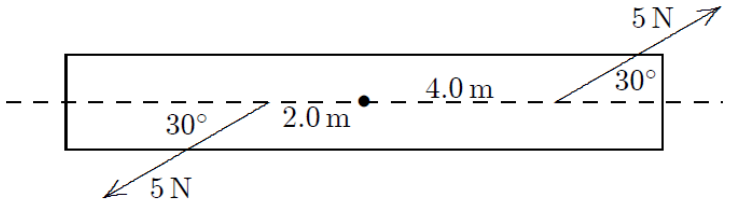
26 A rod is pivoted about its center. A 5-N force is applied 4 m from the pivot and another 5-N force is applied 2 m from the pivot, as shown. The magnitude of the total torque about the pivot (in N·m) is:



[PQ10, #2]

A. 0
B. 5
C. 8.7
D. 15
E. 26

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27 A disk with a rotational inertia of $5.0\ \text{kg} \cdot \text{m}^2$ and a radius of 0.25 m rotates on a frictionless fixed axis perpendicular to the disk and through its center. A force of 8.0 N is applied along the rotation axis. The angular acceleration of the disk is:

A. 0
B. $0.40\ \text{rad/s}^2$
C. $0.60\ \text{rad/s}^2$
D. $1.0\ \text{rad/s}^2$
E. $2.5\ \text{rad/s}^2$

[PQ10, #3]

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28 The coefficient of static friction between a certain cylinder and a horizontal floor is 0.40. If the rotational inertia of the cylinder about its symmetry axis is given by $I = (1/2)MR^2$, then the magnitude of the maximum acceleration the cylinder can have without sliding is:

A. $0.1g$
B. $0.2g$
C. $0.4g$
D. $0.8g$
E. g

[PQ10, #4]

29 A hoop, a uniform disk, and a uniform sphere, all with the same mass and outer radius, start with the same speed and roll without sliding up identical inclines. Rank the objects according to how high they go, least to greatest.

A. hoop, disk, sphere
B. disk, hoop, sphere
C. sphere, hoop, disk
D. sphere, disk, hoop
E. hoop, sphere, disk

[PQ10, #5]

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30 A 2.0-kg block travels around a 0.50-m radius circle with an angular velocity of 12 rad/s. The magnitude of its angular momentum about the center of the circle is:

A. $6.0\,\mathrm{kg \cdot m^2/s}$
B. $12\,\mathrm{kg \cdot m^2/s}$
C. $48\,\mathrm{kg/m^2 \cdot s}$
D. $72\,\mathrm{kg \cdot m^2/s^2}$
E. $576\,\mathrm{kg/m^2 \cdot s^2}$

[PQ11, #2]

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31 When a man on a frictionless rotating stool extends his arms horizontally, his rotational kinetic energy:

A. must increase
B. must decrease
C. must remain the same
D. may increase or decrease depending on his initial angular velocity
E. may increase or decrease depending on his angular acceleration

[PQ11, #5]

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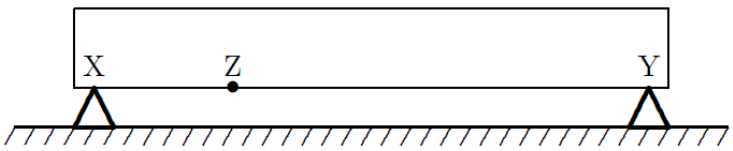
32 A uniform plank is supported by two equal 120-N forces at X and Y, as shown. The support at X is then moved to Z (half-way to the plank center). The supporting forces at Y and Z are then:



A. $F_Y = 240\,\mathrm{N}$, $F_Z = 120\,\mathrm{N}$
B. $F_Y = 200\,\mathrm{N}$, $F_Z = 40\,\mathrm{N}$
C. $F_Y = 40\,\mathrm{N}$, $F_Z = 200\,\mathrm{N}$
D. $F_Y = 80\,\mathrm{N}$, $F_Z = 160\,\mathrm{N}$
E. $F_Y = 160\,\mathrm{N}$, $F_Z = 80\,\mathrm{N}$

[PQ12, #2]

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33 In simple harmonic motion, the magnitude of the acceleration is:

A. constant
B. proportional to the displacement
C. inversely proportional to the displacement
D. greatest when the velocity is greatest
E. never greater than g

[PQ12, #3]

34 The displacement of an object oscillating on a spring is given by $x(t) = x_m \cos(\omega t + \phi)$. If the initial displacement is zero and the initial velocity is in the negative x direction, then the phase constant ϕ is:

[PQ12, #4]

A. 0
B. $\pi/2$ rad
C. π rad
D. $3\pi/2$ rad
E. 2π rad

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35 Five hoops are each pivoted at a point on the rim and allowed to swing as physical pendulums. The masses and radii are

hoop 1: $M = 150\,\text{g}$ and $R = 50\,\text{cm}$
hoop 2: $M = 200\,\text{g}$ and $R = 40\,\text{cm}$
hoop 3: $M = 250\,\text{g}$ and $R = 30\,\text{cm}$
hoop 4: $M = 300\,\text{g}$ and $R = 20\,\text{cm}$
hoop 5: $M = 350\,\text{g}$ and $R = 10\,\text{cm}$

[PQ12, #5]

Order the hoops according to the periods of their motions, smallest to largest.

A. 1, 2, 3, 4, 5
B. 5, 4, 3, 2, 1
C. 1, 2, 3, 5, 4
D. 1, 2, 5, 4, 3
E. 5, 4, 1, 2, 3

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36 The displacement of a string is given by

$$y(x,t) = y_m \sin(kx + \omega t)\,.$$

[PQ13, #1]

The wavelength of the wave is:

A. $2\pi k/\omega$
B. k/ω
C. ωk
D. $2\pi/k$
E. $k/2\pi$

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37 The displacement of a string carrying a traveling sinusoidal wave is given by

$$y(x,t) = y_m \sin(kx - \omega t - \phi)\,.$$

At time $t = 0$ the point at $x = 0$ has a displacement of 0 and is moving in the positive y direction. The phase constant ϕ is:

[PQ13, #2]

A. 45°
B. 90°
C. 135°
D. 180°
E. 270°

38 Water waves in the sea are observed to have a wavelength of 300 m and a frequency of 0.07 Hz. The speed of these waves is:

[PQ13, #3]

A. 0.00021 m/s
B. 2.1 m/s
C. 21 m/s
D. 210 m/s
E. none of these

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39 The tension in a string with a linear mass density of 0.0010 kg/m is 0.40 N. A sinusoidal wave with a wavelength of 20 cm on this string has a frequency of:

[PQ13, #4]

A. 0.0125 Hz
B. 0.25 Hz
C. 100 Hz
D. 630 Hz
E. 2000 Hz

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40 The mathematical forms for three sinusoidal traveling waves are given by

[PQ13, #5]

wave 1: $y(x,t) = (2\,\text{cm})\sin(3x - 6t)$
wave 2: $y(x,t) = (3\,\text{cm})\sin(4x - 12t)$
wave 3: $y(x,t) = (4\,\text{cm})\sin(5x - 11t)$

where x is in meters and t is in seconds. Of these waves:

A. wave 1 has the greatest wave speed and the greatest maximum transverse string speed
B. wave 2 has the greatest wave speed and wave 1 has the greatest maximum transverse string speed
C. wave 3 has the greatest wave speed and the greatest maximum transverse string speed
D. wave 2 has the greatest wave speed and wave 3 has the greatest maximum transverse string speed
E. wave 3 has the greatest wave speed and wave 2 has the greatest maximum transverse string speed

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Question Breakups: *Q1 --- 16*: Test 1 material (40%); *Q17 --- 32*: Test 2 material (40%); *Q33 --- 40*: post-test 2 stuff (20%)

Disclaimer: Questions are in no way designed to be similar to the questions that may appear in the final exam!