first (given)	*last (family)*	**Physics 2211 A**	Nine-digit Tech ID
Name, *printed* as it appears in Canvas		Fall 2021	

Quiz

1A

- **Print** your name and nine-digit Tech ID *very neatly* in the spaces above.
- Free-response problems are numbered I–III. Show all your work clearly, including all steps and logic. Write **darkly**. Blue or black ink is recommended. Do not make any erasures in your free-response work. Cross out anything you do not want evaluated. Box your answer.
- Multiple-choice questions are numbered 1–7. For each, select the answer most nearly correct, circle it on your quiz, and fill the bubble for your answer on this front page.
- Initial the odd pages in the top margin, in case the pages of your quiz get separated.
- The standard formula sheet is on the back of this page, which may be removed from the quiz form if you wish, but it must be submitted.
- If the page for a free-response problem has insufficient space for your work, ask a proctor for an additional sheet. If you wish this work to be evaluated, put your name on the sheet and make a note on the problem page, so graders will know where to look for your work.
- You may use a calculator that cannot store letters, but no other aids or electronic devices.
- Your score will be posted when your quiz has been graded. Quiz grades become final when the next quiz is administered.

Fill in bubbles for your Multiple Choice answers darkly and neatly.

	a	b	c	d	e
1	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
2	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
3	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
4	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
5	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
6	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
7	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
	a	b	c	d	e

Quiz and Exam Formulæ & Constants

$$\vec{v} = \frac{d\vec{r}}{dt}$$

$$\vec{\omega} = \frac{d\vec{\theta}}{dt}$$

$$\vec{a} = \frac{d\vec{v}}{dt}$$

$$\vec{\alpha} = \frac{d\vec{\omega}}{dt}$$

$$v_{\mathrm{sf}} = v_{\mathrm{si}} + a_{\mathrm{s}}\,\Delta t$$

$$\omega_{\mathrm{f}} = \omega_{\mathrm{i}} + \alpha\,\Delta t$$

$$s_{\mathrm{f}} = s_{\mathrm{i}} + v_{\mathrm{si}}\,\Delta t + \tfrac{1}{2}a_{\mathrm{s}}\,(\Delta t)^2$$

$$\theta_{\mathrm{f}} = \theta_{\mathrm{i}} + \omega_{\mathrm{si}}\,\Delta t + \tfrac{1}{2}\alpha\,(\Delta t)^2$$

$$s = r\theta$$

$$v = r\omega$$

$$a_{\mathrm{t}} = r\alpha$$

$$\sum \vec{F} = m\vec{a} = \frac{d\vec{p}}{dt}$$

$$\sum \vec{F}_{\mathrm{ext}} = M\vec{a}_{\mathrm{cm}} = \frac{d\vec{P}}{dt}$$

$$\sum \vec{\tau}_{\mathrm{ext}} = I\vec{\alpha} = \frac{d\vec{L}}{dt}$$

$$f_{\mathrm{s,max}} = \mu_{\mathrm{s}} n$$

$$f_{\mathrm{k}} = \mu_{\mathrm{k}} n$$

$$a_{\mathrm{r}} = \frac{v^2}{r}$$

$$\vec{w} = m\vec{g}$$

$$|\vec{F}_{\mathrm{G}}| = \frac{Gm_1m_2}{|\vec{r}|^2}$$

$$D = \tfrac{1}{2}C\rho A v^2$$

$$\vec{\tau} = \vec{r}\times\vec{F}$$

$$W = \int \vec{F}\cdot d\vec{s}$$

$$W_{\mathrm{ext}} = \Delta K + \Delta U + \Delta E_{\mathrm{th}}$$

$$K = \tfrac{1}{2}mv^2$$

$$K = \tfrac{1}{2}I\omega^2$$

$$U_{\mathrm{g}} = mgy$$

$$U_{\mathrm{s}} = \tfrac{1}{2}k\,(\Delta s)^2$$

$$U_{\mathrm{G}} = -\frac{Gm_1m_2}{r}$$

$$P = \frac{dE_{\mathrm{sys}}}{dt}$$

$$P = \vec{F}\cdot\vec{v}$$

$$\vec{J} = \int \vec{F}\,dt = \Delta\vec{p}$$

$$\vec{p} = m\vec{v}$$

$$\vec{r}_{\mathrm{cm}} = \frac{\sum \vec{r}_i m_i}{\sum m_i}$$

$$\vec{r}_{\mathrm{cm}} = \frac{\int \vec{r}\,dm}{\int dm}$$

$$I = \sum m_i r_i^2$$

$$I = \int r^2\,dm$$

$$I = I_{\mathrm{cm}} + Md^2$$

$$\vec{L} = \vec{r}\times\vec{p}$$

$$\vec{L} = I\vec{\omega}$$

$$x = A\cos(\omega t + \phi_0)$$

$$\vec{a}_{\mathrm{x}} = -\omega^2\vec{x}$$

$$\omega = \sqrt{k/m}$$

$$\omega = 2\pi f = \frac{2\pi}{T}$$

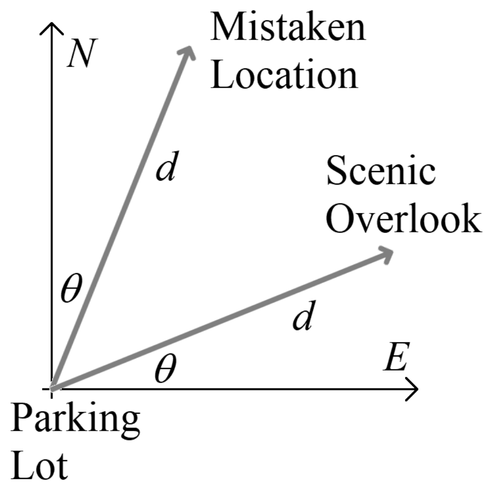
Physical Constants:

Universal Gravitational Constant $G = 6.673\times10^{-11}\,\mathrm{N{\cdot}m^2/kg^2}$
Gravitational Acceleration at Earth's Surface $g = 9.81\,\mathrm{m/s^2}$

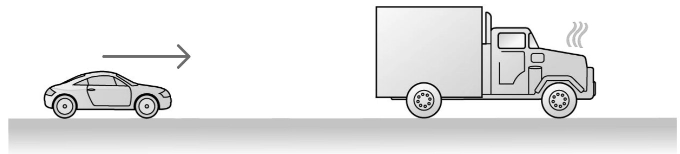
Unless otherwise directed, drag is to be neglected, all problems take place on Earth, use the gravitational definition of weight, and all springs, ropes, and pulleys are ideal. All derivatives and integrals in free-response problems must be evaluated.

You may remove this sheet from your Quiz or Exam, but it must be submitted

I. (16 points) While driving through the mountains, you stop to see the view from a scenic overlook. Parking your car, you check your map and start walking toward the overlook, a distance $d = 880\,\text{m}$ away, in the direction $\theta = 17°$ east of north. Halfway there (that is, after walking 440 m), you realized you'd misread your map! The overlook was actually a distance $d = 880\,\text{m}$ from the parking lot, in the direction $\theta = 17°$ **north of east!** How far must you walk to get to the overlook from where you are now, and in what direction? (*On Earth.*)



II. (16 points) A texting driver looks up and sees a stalled truck stopped in the road straight ahead. They apply their brakes 35 m from the truck, but they hit the truck 3.8 s later, traveling at 7.5 m/s. What is the magnitude of their acceleration while braking? (*On Earth.*)



1. (6 points) In the problem above, describe the angle between the car's velocity and acceleration while braking.

   (a) The angle between the velocity and acceleration is 180°.
   (b) The angle between the velocity and acceleration is 0°.
   (c) The angle between the velocity and acceleration is between 90° and 180°.
   (d) The angle between the velocity and acceleration is 90°.
   (e) The angle between the velocity and acceleration is between 0° and 90°.

III. (16 points) An object moves in one dimension with a position x that depends on time t according to

$$x = At^4 + Bt^2 + C$$

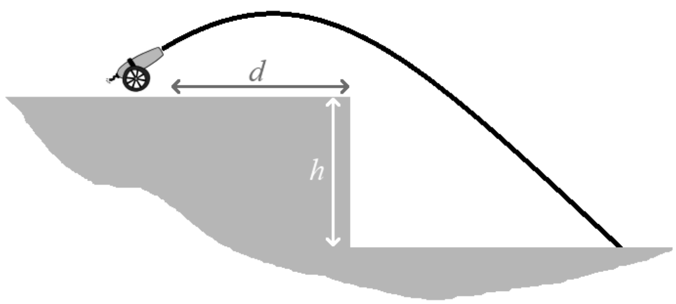
where $A = 0.20\,\mathrm{m/s^4}$, $B = -0.40\,\mathrm{m/s^2}$, and $C = 0.80\,\mathrm{m}$. What is the object's average acceleration between times $t = -1.5\,\mathrm{s}$ and $t = 2.0\,\mathrm{s}$?

2. (6 points) In the problem above, is the object at the origin at time $t = 0$? Is at rest at time $t = 0$?

   (a) At time $t = 0$, the object is not at the origin, and it is not at rest.
   (b) At time $t = 0$, the object is at the origin, but the concept of "rest" does not apply to objects whose position depends on t^4.
   (c) At time $t = 0$, the object is not at the origin, but it is at rest.
   (d) At time $t = 0$, the object is at the origin, and it is at rest.
   (e) At time $t = 0$, the object is at the origin, but it is not at rest.

3. (8 points) A cannon is a distance d from a cliff with height h. It is aimed 30° above the horizontal, and fires a shell that lands on the plain below, as shown. If the canon is aimed 60° above the horizontal and fires a shell with the same launch speed, how should the canon be positioned so this shell lands in the same position as the one fired at 30°? (*On Earth.*)

(a) Whether the cannon should be moved left or right depends on the relationship between h and d.
(b) The cannon should be moved closer to the edge of the cliff (that is, to the right).
(c) Whether the cannon should be moved left or right depends on the launch speed.
(d) The cannon should be moved farther from the edge of the cliff (that is, to the left).
(e) The cannon should be kept in the same position.



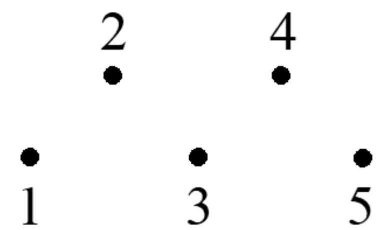
4. (8 points) An airline pilot wants to fly directly north from San Francisco, California, to Eugene, Oregon. There is a steady wind from the northwest, so they point their 'plane at an angle θ west of north. On the southward return flight, the same steady wind blows from the northwest, so they point their 'plane at an angle ϕ west of south. If it can be determined, how are θ and ϕ related? (*On Earth.*)

(a) The relationship between θ and ϕ depends on the relationship between wind speed and the 'plane's speed through the air.
(b) $\phi = \theta$
(c) $\phi > \theta$
(d) The relationship between θ and ϕ depends on the distance between San Francisco and Eugene.
(e) $\phi < \theta$

Initial:

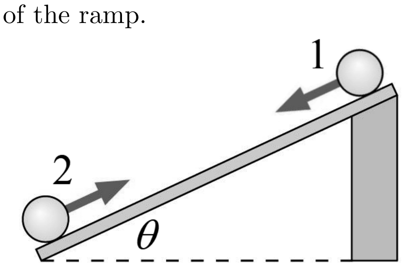
5. (8 points) Consider an object moving with the motion diagram shown. What is the direction of the object's average acceleration around point 3?

   (a) No direction, as the magnitude is zero.
   (b) To the left.
   (c) Up the page.
   (d) To the right.
   (e) Down the page.



6. (8 points) When ball 1 is released from the top of the ramp, it has speed v when it reaches the bottom. When ball 2 is launched up the ramp with speed v, it stops when it reaches the top. Consider the situation in which ball 1 is released from the top, and ball 2 is launched with speed v from the bottom at the same time. If it can be determined, where is their meeting point in relation to the midpoint of the ramp? (*On Earth.*)

   (a) The relation between their meeting point and the midpoint cannot be determined unless v is known.
   (b) The relation between their meeting point and the midpoint cannot be determined unless θ is known.
   (c) They meet at the midpoint of the ramp.
   (d) They meet above the midpoint of the ramp.
   (e) They meet below the midpoint of the ramp.



7. (8 points) An object moving in one dimension has an acceleration that depends on time, as shown. If the object is at rest when time $t = 0$, at what point does the object have its maximum speed?

(a) D
(b) B
(c) E
(d) C
(e) A