# Welcome to Sounds of Music!

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This test is worth 229 points and consists of 3 sections:

**True False**: 20 questions, 1.15 points each, 23/229 points
**Multiple Choice**: 40 questions, 2-4.5 points each, 129.5/229 points
**Free Response**: 17 questions, 3-10 points each, 76.5/229 points

Unless specified, **assume the velocity of sound to be 343 m/s.**

## Free Response Instructions:

Unless specified, work is not required. A correct answer will receive full credit. Partial credit will be given to those who provide an accurate explanation/work but have an incorrect final answer. Given the length of the test and its online format, we are only asking for a few sentences of explanation/work. Don't worry about wasting time formatting mathematical work, we will do our best to decipher it. Round any answers to 3 decimal points.

We will not be adjusting questions during the testing period. If you find any mistakes or have any technical issues, please use the built in chat feature and follow the guidelines listed out here (https://docs.google.com/document/d/1l5I0B0gCLWU0Dznh1-_vvIAE_QWDBBHmMnc0NTjdunA/edit?usp=sharing). Questions that are found to contain mistakes will be thrown out at the discretion of the ES.

This test is purposefully very long and is not meant to be finish-able. We highly recommend spending a few minutes skimming through the test and dividing it with your partner. There is no penalty for guessing so it is in your best interest to put an answer down for as many questions as possible.

If at any point, Scilympiad is having trouble saving longer answers (short answer, etc.) please email your response to scioly@mit.edu with the title "[Team #]-[Event Name]-[Question #]" with any other details identifying the question in the body of the email.

Good luck and have fun :) <small>apologies in advance</small>

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**1. (1.15 pts)**   Idiophones only vibrate longitudinally, not transversely.

○ True      ● False

---

**2. (1.15 pts)**   Both flutes and piccolos are open cylindrical instruments.

● True      ○ False

---

**3. (1.15 pts)**   Piano's are well established to be Idiophones, but it is often debated whether they are part of the Percussion or String family.

○ True      ● False

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**4. (1.15 pts)**   The Alto Saxophone is part of the woodwind family.

● True      ○ False

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**5. (1.15 pts)**   The crest is the highest point of a wave.

● True      ○ False

---

**6. (1.15 pts)**   An antinode is a position of minimum displacement.

○ True    ● False

---

**7. (1.15 pts)**    Electromagnetic waves require a medium to travel through.

○ True    ● False

---

**8. (1.15 pts)**    Longitudinal waves are waves that vibrate perpendicular to the direction that the wave is moving.

○ True    ● False

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**9. (1.15 pts)**    Reverberation is the time it takes for a sound to decay to 1 millionth of its original amplitude.

○ True    ● False

---

**10. (1.15 pts)**    Pitch is a purely objective perception of frequency.

○ True    ● False

---

**11. (1.15 pts)**    The Bernoulli effect is derived from the principle of conservation of energy.

● True    ○ False

---

**12. (1.15 pts)**    The decibel scale uses relative intensity, rather than being an absolute loudness scale.

● True    ○ False

---

**13. (1.15 pts)**    The instrument, along with the column of air, vibrate to produce sounds in Aerophones.

○ True    ● False

---

**14. (1.15 pts)**    Wind instruments vary pitch by covering up holes in the instrument, causing the velocity of the air to change.

○ True    ● False

---

**15. (1.15 pts)**    In 3/4 time, a dotted quarter note and 6 1/16th notes would cover exactly one measure.

● True    ○ False

---

**16. (1.15 pts)**    Largo is a slower tempo than grave.

○ True    ● False

---

**17. (1.15 pts)**    The interval between G4 and E#5 is a minor 7th.

○ True    ● False

---

**18. (1.15 pts)**    Gb Major is the key signature with the most flats.

/

○ True    ● False

---

**19. (1.15 pts)**    The velocity of sound within a fluid is proportional to the square root of its density.

○ True    ● False

---

**20. (1.15 pts)**    Wavelength is inversely proportional to frequency.

● True    ○ False

---

**21. (2.00 pts)**    What is the relative major and minor key of a key signature with 5 sharps?

○ A)  E major/ A minor
● B)  B major/ G# minor
○ C)  A major/ E minor
○ D)  E major/ C# minor
○ E)  B major/ F minor
○ F)  A major/ F# minor

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**22. (3.00 pts)**    What is the interval between a key signature on the circle of fifths and the key directly across from it?
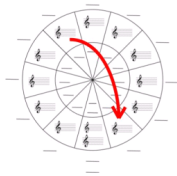


○ A)  Major 3rd
○ B)  Perfect 4th
● C)  Tritone
○ D)  Perfect 5th
○ E)  Major 6th
○ F)  Major 7th

---

**23. (2.50 pts)**    How many whole tones are between the Major 2nd and tritone of the same root?

○ A)  0
○ B)  1
● C)  2
○ D)  3
○ E)  4
○ F)  5

---

**24. (2.50 pts)**    Which musical intervals are enharmonic equivalents? (Select all that apply)

/

- [ ] A) Minor 6th
- [ ] B) Major 7th
- [ ] C) Diminished 6th
- [x] D) Augmented 6th
- [ ] E) Diminished 7th
- [x] F) Minor 7th

---

**25. (3.00 pts)**  What are the common tones between the E major and F# minor scales?

- ( ) A) A, B, C#, D, E, F#, G#
- ( ) B) A, B, C#, D#, E, F#, G#
- (•) C) A, B, C#, E, F#, G#
- ( ) D) C#, D#, E, F#, G#
- ( ) E) A, B, C#, E, F#
- ( ) F) B, C#, D, E, F#

---

**26. (2.50 pts)**  The tonic of a major key is the _____ of the relative minor key.

- ( ) A) Supertonic
- (•) B) Mediant
- ( ) C) Subdominant
- ( ) D) Dominant
- ( ) E) Submediant
- ( ) F) Subtonic

---

**27. (3.00 pts)**  If a particular interval with a diminished quality goes through an inversion, what is the quality of the new interval?

- (•) A) Augmented
- ( ) B) Major
- ( ) C) Perfect
- ( ) D) Minor
- ( ) E) Unison
- ( ) F) Diminished

---

**28. (4.00 pts)**  The top 2 notes in a root position musical triad is shown below(root note intentionally hidden). Which of the following triads could this be? (Select all that apply)



(Mark **ALL** correct answers)
- [ ] A) Major Triad
- [x] B) Minor Triad
- [ ] C) Dominant Triad
- [ ] D) Diminished Triad
- [x] E) Augmented Triad

/

**29. (4.00 pts)**    Identify the following cadence.



- ○ A)  Perfect Authentic Cadence
- ○ B)  Imperfect Authentic Cadence
- ◉ C)  Plagal Cadence
- ○ D)  Half Cadence
- ○ E)  Deceptive Cadence

**30. (4.00 pts)**    Identify the following cadence.



- ○ A)  Perfect Authentic Cadence
- ○ B)  Imperfect Authentic Cadence
- ○ C)  Plagal Cadence
- ○ D)  Half Cadence
- ◉ E)  Deceptive Cadence

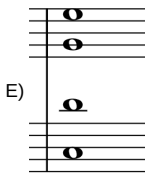**31. (4.50 pts)**    By using common tone principle, which chord follows this chord progression (**I->vi**)?
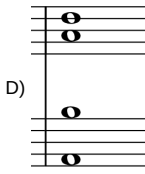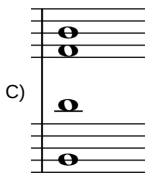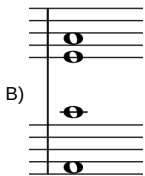


A)



B)



C)



D)



/

E)

F)
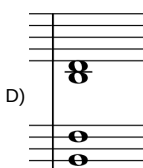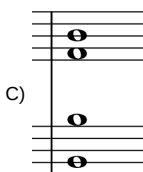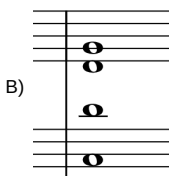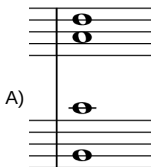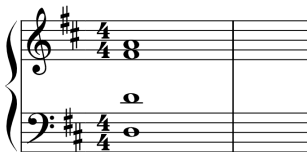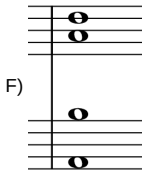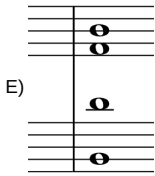
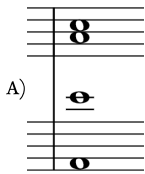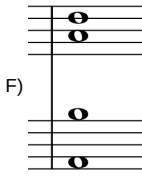- A) A
- B) B
- C) C
- D) D
- ● E) E
- F) F

**32. (4.50 pts)**

By using the contrary motion principle, which chord follows the above chord progression (**IV->V**)?

A)

B)

C)

D)

E)

/

F)

- ○ A) A
- ● B) B
- ○ C) C
- ○ D) D
- ○ E) E
- ○ F) F

**33. (3.50 pts)**
The note A4 is standardly known to have a frequency of 440 Hz. What is the difference in frequency between the note a perfect fourth above A4 when tuned in 12-Tone Equal Temperament and Just intonation?

- ○ A) 0 Hz
- ○ B) 0.389 Hz
- ● C) 0.663 Hz
- ○ D) 0.918 Hz
- ○ E) 1.281 Hz
- ○ F) 1.381 Hz

**34. (4.00 pts)**   Which of the following are pros for using just intonation rather than equal temperament? (Select all that apply)

(Mark **ALL** correct answers)
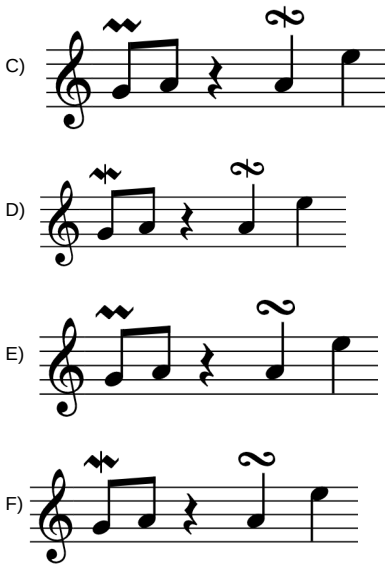- ☐ A) Logarithmic scale
- ☑ B) Follows stable overtone series
- ☑ C) Intervals sound pure and clean
- ☑ D) Tuning instruments is easier
- ☑ E) Preserves the perfect 5th ratio
- ☐ F) Easy to transpose music between keys

**35. (4.00 pts)**



Which of the following choices have the rhythmic equivalence of the above measure (edit: third note should be a G, not an A in the above image):



A)



B)

C)

D)

E)

F)

○ A) A
○ B) B
○ C) C
○ D) D
○ E) E
● F) F

**36. (3.50 pts)**
Pythagorean Tuning is based on the simple perfect 5th and perfect octave intervals. The frequency interval is 1.5 for a perfect 5th and 2 for a perfect octave. To form a perfect 4th interval with Pythagorean tuning you would have to go _____

● A)  Down 1 P5 interval and up 1 P8 interval
○ B)  Up 1 P5 interval and down 1 P8 interval
○ C)  Down 2 P5 intervals and up 1 P8 interval
○ D)  Down 3 P5 intervals and up 2 P8 intervals
○ E)  Up 5 P5 intervals and down 2 P8 intervals
○ F)  Up 3 P5 intervals and down 2 P8 intervals

**37. (2.50 pts)**
Daniel is playing his viola with Yitian's oboe. They are trying to tune, and Yitian is playing exactly an A4 (440 Hz). Daniel is a little sharp, causing 8 beats per second to be heard. How many cents off is he?

○ A)  -31.2 cents
○ B)  -11.44 cents
○ C)  -9.39 cents
○ D)  9.39 cents
○ E)  11.44 cents
● F)  31.2 cents

**38. (3.50 pts)**
Two different pieces are being played. Piece A has a time signature of 5/8 and is played at eighth note = 110. Piece B has a time signature of 3/4 and is played at quarter note = 70. Approximately how many measures of piece A would it take to be equivalent in time to 7 measures of piece B?

○ A)  5.2 measures
○ B)  5.5 measures

○ C) 5.9 measures

◉ D) 6.6 measures

○ E) 7.2 measures

○ F) 49.1 measures

**39. (3.00 pts)** Which of the following are true of reeds? (Select all that apply)

(Mark **ALL** correct answers)

☑ A) Double reed instruments have no mouthpiece

☐ B) The reed itself does not vibrate

☐ C) Embouchure is not relevant for reed instruments since the air is not directly entering the instrument

☑ D) Typically in modern bands, reed instruments belong to the woodwind family

**40. (3.00 pts)**
A pipe starts at point A with a diameter of 10 cm and at a height of 10 m. Then over a distance of 6 m, the pipe rises to point B at a height of 20 m with a new diameter of 5 cm. If the velocity of the water in the pipe starts at 20 m/s, what will the speed be at point B?

○ A) 20 m/s

○ B) 40 m/s

○ C) 50 m/s

○ D) 60 m/s

◉ E) 80 m/s

○ F) 100 m/s

**41. (2.50 pts)** A guitar string is vibrating at its fourth harmonic. How many nodes and antinodes appear on its standing wave?

○ A) Four nodes, three antinodes

○ B) Three nodes, four antinodes

○ C) Four nodes, four antinodes

◉ D) Five nodes, four antinodes

○ E) Four nodes, five antinodes

**42. (3.00 pts)**
John and Sarah are both playing the fundamental of their open ended tubes, one with a length of 34.75 cm, and the other with a length of 35 cm. What is the beat frequency heard by them if it is a 40 °C day?

○ A) 3.8 Hz

◉ B) 3.6 Hz

○ C) 3.4 Hz

○ D) 0.5 Hz

○ E) 0.4 Hz

○ F) 0.3 Hz

**43. (3.50 pts)** Let the temperature of air be 5 degrees Celsius. How much must the temperature **increase by** in order to raise the speed of sound by 2%?

○ A) 9.99°C

◉ B) 11.13°C

○ C) 14.39°C

○ D) 16.33°C

**44. (3.50 pts)**

Eliza is playing on an **open ended** tube of length 2 meters. What frequency must she play at to produce a standing wave with 5 segments in the length of the tube? (For reference, a 3rd harmonic on a **closed pipe** has 1.5 segments)

● A) 428.75 Hz

○ B) 214.38 Hz

○ C) 857.5 Hz

○ D) 171.5 Hz

○ E) 1071.88 Hz

○ F) 343 Hz

**45. (4.00 pts)**

Alden is playing the 3rd overtone on a 2 meter closed piped instrument. Ethan is playing the 4th overtone on a 1.5 meter open piped instrument. What is the absolute difference in their wavelengths of the air column?

○ A) 0

○ B) 0.25

○ C) 0.33

● D) 0.54

○ E) 0.66

○ F) 0.75

**46. (3.00 pts)**    A string has a length of 40 cm and vibrates at a frequency of 500 Hz. If there is 60 N of tension in the string, what is the linear mass density of the string?

● A) 0.375 g/m

○ B) 0.1500 g/m

○ C) 2.667 g/m

○ D) 1.500 g/m

○ E) 6.667 g/m

○ F) 2.184 g/m

**47. (3.00 pts)**

Jorge is in a recording studio using a microphone to record his vocals. The audio technician wants him to lean in so that his vocals are louder. If he is originally 30 cm away from the microphone and leans in so that now he is only 10 cm away, what is the change in decibels that microphone picks up?

○ A) 29.6 dB

● B) 9.5 dB

○ C) 4.8 dB

○ D) 14.8 dB

○ E) 22.1 dB

○ F) More information needed

**48. (2.00 pts)**

Jorge's manager Tatianna is trying to install soundproof wall covers in their studio so as to not annoy their neighbors. Which of the following would theoretically make the best material for them to use?

○ A) Glass

B) Cork

● C) Snow

D) Wood

E) Concrete

**49. (2.00 pts)**

The glass harp is an instrument made up of several wine glasses filled with varying amounts of water. The instrument is played by rubbing your fingers against the rims of different glasses to make different sounds. What is the Hornbostel-Sachs classification of this instrument?

● A) Idiophone

B) Membranophone

C) Chordophone

D) Aerophone

E) Electrophone

**50. (3.00 pts)**

A long string is attached to an oscillator at one end and a hanging block at the other end. If the block has a mass of m and the string has a linear mass density of u, what is the frequency at which the oscillator and string vibrate at?
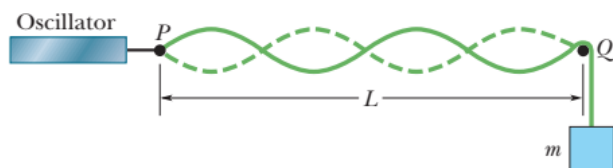


● A)

$$\frac{2}{L}\sqrt{\frac{mg}{u}}$$

B)

$$\frac{4}{L}\sqrt{\frac{mg}{u}}$$

C)

$$\frac{4}{L}\sqrt{\frac{u}{mg}}$$

D)

$$2L\sqrt{\frac{u}{mg}}$$

E)

$$4L\sqrt{\frac{mg}{u}}$$

**51. (3.50 pts)**

Ray is trying to tune his guitar with his friend Emma. When Ray plays the G3 string, it plays the note perfectly on pitch. However, when Emma plays the G3 string, they hear a beat frequency of 4 Hz, and notice that Emma's pitch sounds a bit too sharp. If their guitars are 1 m long, and the linear density of the strings are 7.20 g/m, how much should the tension in the G3 string of Emma's guitar change by in order for the two guitars to be in tune with each other?

A) +45.6 N

● B) -45.6 N

C) +22.8 N

D) -22.8 N

E) +11.4 N

F) -11.4 N

**52. (3.00 pts)**
Lucy is jogging towards a firehouse at a speed of 5 m/s. As she is jogging, the fire alarm goes off, and she hears a frequency of 550 Hz. If it is a chilly 5 °C day outside, what is the actual frequency of the alarm?

A) 564.0 Hz

B) 542.2 Hz

● C) 541.9 Hz

D) 548.2 Hz

E) 558.2 Hz

F) 528.1 Hz

**53. (2.00 pts)**
Trumpets are closed tube instruments, meaning that they only can play odd harmonics, however it is very desirable for players to be able to play all harmonics. Which part of the trumpet allows for lower resonance frequencies to be pushed up to a higher frequency?

A) Mouthpiece

● B) Bell

C) First valve slid

D) Third valve slide

E) All of the above

F) None of the above

Use the following information for the next two questions The two speakers below both have a power output of 50 watts and are positioned 50 meters apart. Point A is located halfway between the two speakers and Point B is located halfway between Point A and the right speaker.
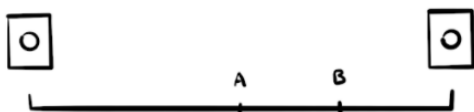


**54. (3.00 pts)**   What would the sound intensity at point A if the two speakers are both set are their maximum volumes?

A) 98 dB

B) 95 dB

● C) 101 dB

D) 92 dB

E) 104 dB

F) 108 dB

**55. (3.00 pts)**   What would the sound intensity at a point B if the two speakers be if they are both set are their maximum volumes?

● A) 105 dB

B) 98 dB

C) 101 dB

○ D) 108 dB

○ E) 89 dB

○ F) 109 dB

**56. (3.00 pts)** How long would it take a sound in a concrete 10m x 10m x 25m room to decay by 120 dB? The absorption coefficient for concrete is 0.01.

○ A) 7.73 seconds

○ B) 8.81 seconds

○ C) 17.62

⦿ D) 67.14 seconds

○ E) 297.93 seconds

○ F) 303.33 seconds

**57. (3.50 pts)**
Melissa is trying to practice playing harmonics on her violin. This is done by taking an open string and lightly placing a finger on various points along the string, essentially creating a node. If Melissa wants to play the D string (D4) but produce a pitch an octave and fifth above (A5), where along the string should she place her finger?

○ A) Halfway between nut and bridge

⦿ B) A third of the way from either the nut and bridge

○ C) A fourth of the way from either the nut and bridge

○ D) A fifth of the way from either the nut and bridge

○ E) Any position on the string will be able to create a A5

○ F) No position on the string will be able to create a A5

**58. (4.00 pts)**
Melissa also wants to practice playing false harmonics on her violin. A false harmonic can be produced by firmly pressing down on a string using one finger and lightly placing a finger along the string, again creating a node. If Melissa wants to finger a G4 on the D string (D4) but produce a pitch an octave and fifth above (D6), where along the string should she place her finger?

○ A) Halfway between G4 and bridge

⦿ B) A third of the way from either G4 and bridge

○ C) A fourth of the way from either G4 and bridge

○ D) A fifth of the way from either G4 and bridge

○ E) Any position on the string will be able to create a D6

○ F) No position on the string will be able to create a D6

**59. (4.00 pts)** Given the Fourier Spectrum shown above, approximately what note is the trombone playing?
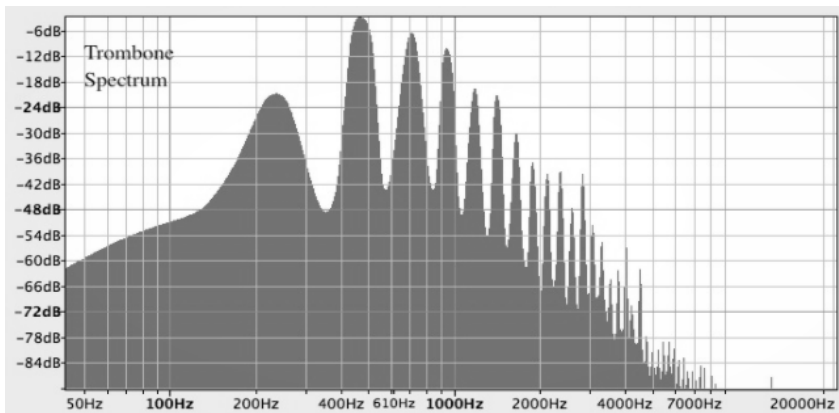


⦿ A) A#3/Bb3

B) B4

C) F5

D) A#5/Bb5

E) C6

F) D#6/Eb6

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**60. (2.50 pts)** Which heavily damped system would a diving board go under?

● A) Underdamped

○ B) Critically Damped

○ C) Overdamped

○ D) None of the Above

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**61. (5.00 pts)** An augmented 14th is ____ minor 3rd intervals above an augmented 4th.

**Expected Answer:** 6 [1 point partial if 8 is given]

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The two following questions refer to the passage below:



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**62. (5.00 pts)** How many measures does this short passage have?
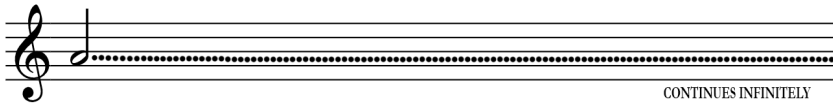
**Expected Answer:** 8

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**63. (3.00 pts)** How many seconds would it take to play this passage in full?

**Expected Answer:** 20 (continuation if answer is 2.5 times answer from previous question)

**64. (5.00 pts)**  The note "β" is 5 octaves above the note "α". If α is the fundamental frequency, which harmonic is β.

**Expected Answer:** 32nd harmonic

**65. (5.00 pts)**  If an **1/8th note** is considered **2 beats**, how many beats does this note have?



CONTINUES INFINITELY

**Expected Answer:** 16

The following setup is for the next **three questions**.

HARMONIC MOTION! The general differential equation found below can be used to describe the motion of an oscillating object. The constant c is equal to the damping constant and k is the elastic spring constant.

$$ma + cv + kx = F_{ext}$$

**66. (4.50 pts)**
Simple Harmonic Motion: In this situation the object will oscillate infinity and no damping forces. You can use the following equation which can be used to model simple harmonic motion. The term $x_0$ is the initial position at t=0s and $v_0$ is the initial velocity at t=0s.

$$x(t) = \sqrt{x_0^2 + \frac{v_0^2}{\frac{k}{m}}} \cos\left(\sqrt{\frac{k}{m}}\, t - arctan\left(\frac{v_0}{x_0\sqrt{\frac{k}{m}}}\right)\right)$$

Write the equation of the simple harmonic motion that is described in the graph below (y-axis is x(t) and x-axis is time). The k constant for this spring is 5 N/m and the mass of the object is 25 kg.

Hint: x(t)=<u>A</u>cos(<u>B</u>t-<u>C</u>)
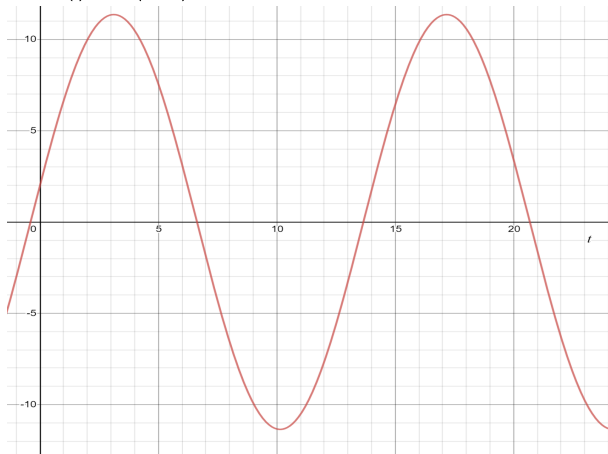
**Expected Answer:** x(t)=(11.36±2.3)cos[(.447±0)t-(1.394±0.05)] x0= 2 m v0 = 5 m/s k = 5 N/m m = 25 kg 1.5pt for setting up equation, 1 pt for each blank (ABC from hint)

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### 67. (3.00 pts)

Damped Unforced Vibrations: If the spring-mass system from the previous question now has internal friction in the spring with a damping constant of 15 kg/s, what type of damped vibration would this be? [Must show proper work for full credit]

**Expected Answer:** Underdamped c^2-4mk<0 15^2-4(25)(5) = -275 < 0 1/2 points for underdamped, 1/2 points for work

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### 68. (4.50 pts)

Undamped Forced Vibrations: Sometimes an external force acts on the spring-mass system: $F = F_0 cos(\omega t)$. If $\omega$ is the frequency of the force function and $\omega_0$ is the natural frequency of the oscillating motion describe what would happen to the wave's amplitude when $\omega_0 = \omega$ and $\omega_0 \neq \omega$.

**Expected Answer:** When w0 = w, the amplitude of the oscillating motion will reach infinity as time approaches infinity. [2.25 pt] When w0 does not = w there could be multiple local maximums and minimums in each full rotation(2pi radians) or amplitude does not ever reach infinity. [2.25 pt]

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### 69. (5.00 pts)

A steel wire has a 3 mm diameter and is 2 m long. The wire is suspending a 2.5 kg mass from a beam. A transverse wave is sent along the wire by hitting it lightly. How fast will this wave travel? The density of steel is 8,050 kg/m³. Take acceleration to be 9.8 m/s² and pi to be 3.14

**Expected Answer:** 20.755 m/s v = sqrt(S/u) S = mass*acceleration = 2.5 * 9.8 u = p*A = 8050*(3.14*(3/2e-3)^2)

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### 70. (4.00 pts)

Tarif and Ravi are playing closed organ pipes. Ravi's organ has a length of 0.75 meters and is slightly shorter than Tarif's. 10 beats per second are heard between the fundamentals of these organ pipes. What is the length of Tarif's organ pipe?

**Expected Answer:** 0.822 meters 10 = 343/(4*0.75) - 343/(4*L)

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### 71. (4.50 pts)

5 beats per second are heard when two tuning forks are played simultaneously. Then, a small piece of cardboard is attached to one prong of the first tuning fork. After the forks are played again, 8 beats per second are heard. If the second fork has a frequency of 280 Hz, what is the **original** frequency of the first fork? (provide a short explanation why)

**Expected Answer:** 275 Hz The beats increased, so the first fork must have a lower frequency than the second fork (since adding the cardboard would decrease the pitch). 280 - 5 = 275 Hz

The **two** following questions refer to this scenario.

A drone is flying directly away from a stationary observer towards a cliff at a velocity of 12 m/s, emitting a frequency of 550 Hz.

**72. (3.00 pts)**    What is the frequency the observer hears directly from the drone?

**Expected Answer:** 531.41 Hz f = 550*[343/(343+12)]

**73. (4.00 pts)**    What is the frequency the observer hears in the echo that is reflected from the cliff?

**Expected Answer:** 569.94 Hz f = 550*[343/(343-12)] The frequency would not change after being reflected, so the observer would hear whatever frequency is heard at the cliff itself.

The **three** following questions refer to this scenario.

Two toy planes A and B are flying in the sky. Plane A is flying towards point P whereas Plan B is flying away from point P as shown in the diagram. Plane A flies with a velocity of 23.5 m/s and plane B flies with a velocity of 50 m/s. The angle φ shown in the diagram is 130°.
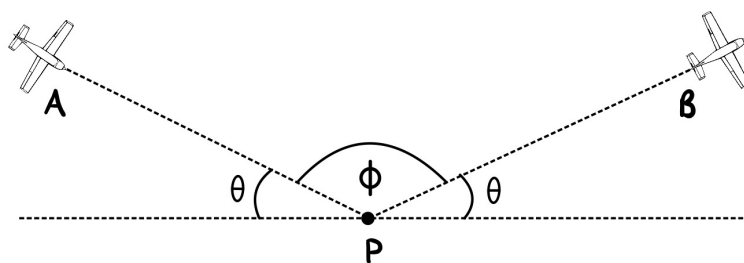


**74. (2.00 pts)**    What is the velocity of plane B with respect to plane A?

**Expected Answer:** 39.26 m/s If φ = 130°, then θ = 25°

**75. (2.00 pts)**    What is the velocity of plane A with respect to plane B?

**Expected Answer:** 39.26 m/s If φ = 130°, then θ = 25° Question 83 and 82 should be negatives oh each other. If they are the same sign, take 1pt off

**76. (6.00 pts)**

If plane A releases a short honking sound with a frequency of 200 Hz, what approximately note would a toy person in plane B hear? You may assume that the speed of sound in air is 343 m/s.

**Expected Answer:** fr= 185.1 ≈ F#3 or Gb3 If φ = 130°, then θ = 25° fr=((c-VBcos) / (c -VAcos))f

**77. (11.00 pts)**

If both speakers are playing a pure tone of A4, what is their phase difference in radians(between 0 and 2pi) if the person experiences complete constructive interference? **It is in your best interest to write out your steps for partial credit.**
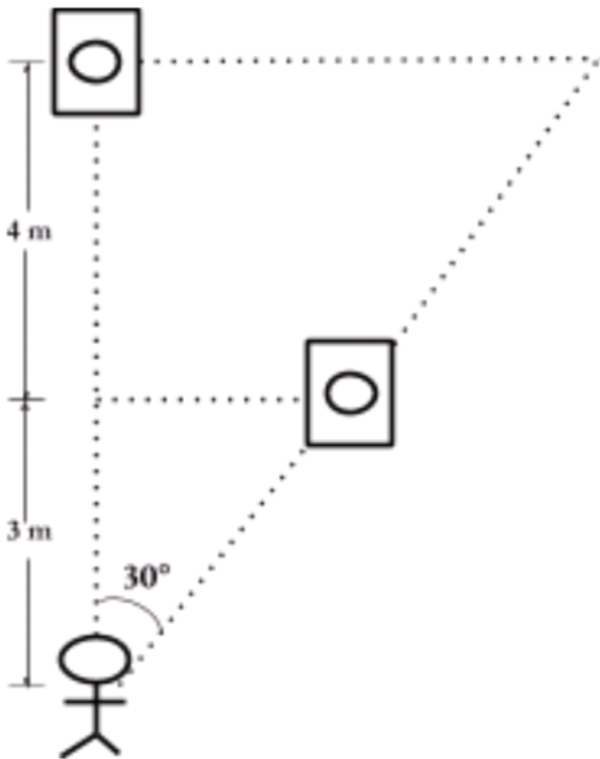


**Expected Answer:** 3.367 radians Wavelength = 343/440=0.77954 m Path difference = 7 - (3/cos30) = 3.53589m mod(3.535, 0.77954) = 0.41771m 0.41771/wavelength = .41771/.77964= 0.5358 rotations 0.5358 rotations * 2pi radians = 3.36682 radians

# Congrats on finishing! go eat some french toast