

MASTER.S DEGREE IN OPTOMETRY AND VISION SCIENCE  
**EXAMPLES OF QUESTIONS THAT WILL BE ASKED TO CANDIDATES DURING THE ADMISSION  
INTERVIEW**

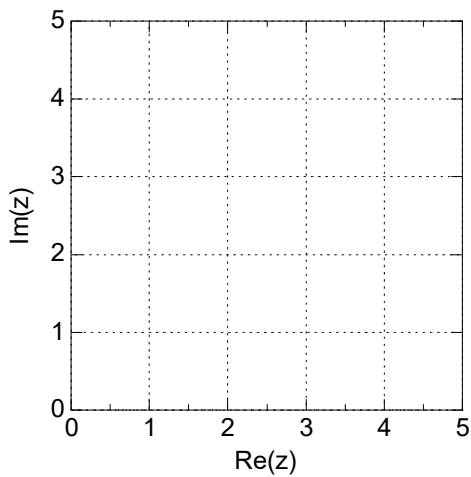
The following pages in this document contain examples of questions similar to those that will be asked to candidates during the oral interview. Candidates may respond orally and/or use paper and pen for any drawings they wish to present to the board during the interview.

**TOPIC 1**

1) Write the first derivative function  $f'(x)$  of the mathematical function  $f(x) = 5x^2 + 3x - 7$   
 $f'(x) = \dots\dots\dots$

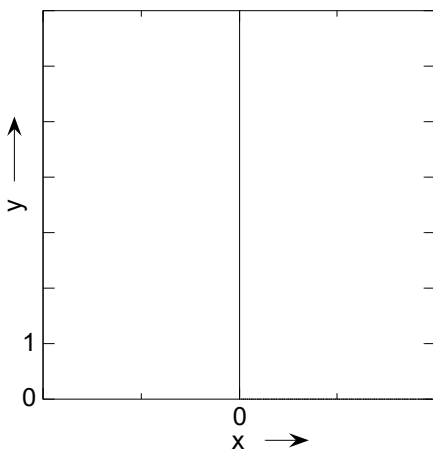
2) Write the antiderivative of the mathematical function  $\int 5x \, dx = \dots\dots\dots$

3) Calculate the following definite integral  $\int_0^{\frac{\pi}{2}} \cos(x) \, dx =$

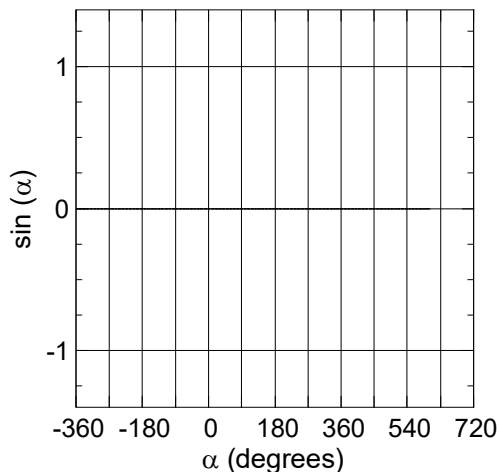


4) Show the complex number  $z = 3+2i$  as a vector in the Argand-Gauss plane.

5) What is the modulus of the complex number  $z=1+2i$ ?



6) Show the graph of the function  $y = e^x$  paying attention to the value assumed by the function when  $x = 0$ .

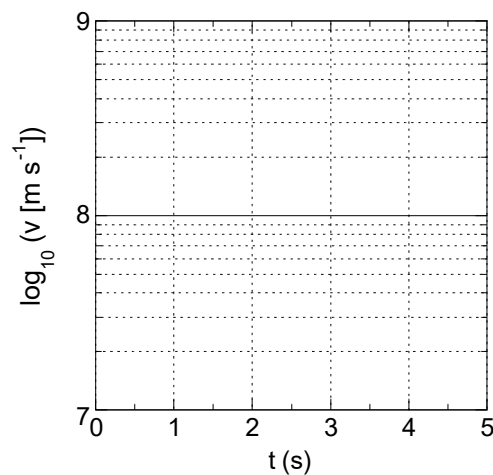
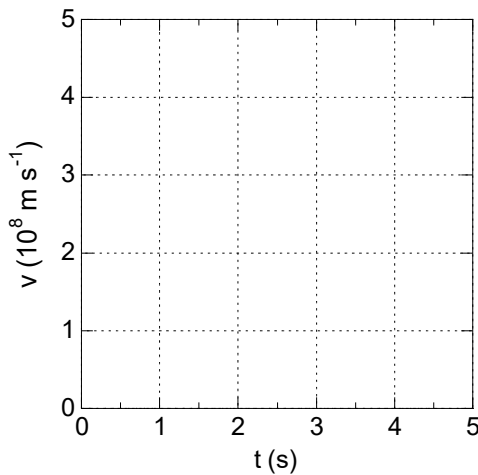


7) Show the graph of the trigonometric function  $\sin(\alpha)$  as the angle  $\alpha$  varies within the range of values for  $\alpha$  shown in the figure.

## TOPIC 2

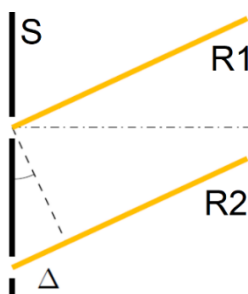
- 1) Consider a source of light that emits  $10^6$  photons every second. Each photon has an energy equal to  $3 \cdot 10^{-19}$  Joule. Calculate the power of the light emitted by the source. Provide both the numerical value and its unit of measurement.
- 2) What are the units of measurement in the International System of the following physical quantities?  
 Pressure: \_\_\_\_\_  
 Density: \_\_\_\_\_  
 Acceleration: \_\_\_\_\_
- 3) What are the units of measurement in the International System of the following physical quantities?  
 Mass: \_\_\_\_\_  
 Force: \_\_\_\_\_  
 Energy: \_\_\_\_\_
- 4) What physical quantities do the following units of measurement correspond to?  
 hertz: \_\_\_\_\_  
 Pascal: \_\_\_\_\_  
 watt: \_\_\_\_\_
- 5) Considering that the speed of light in vacuum is  $3 \cdot 10^8 \text{ m s}^{-1}$ , calculate the time taken by light to travel a distance of  $6 \cdot 10^8 \text{ m}$ .
- 6) For a harmonic motion, the displacement  $x(t)$  as a function of time  $t$  can be described by the equation  $x(t) = A \cos(\omega t)$ , where  $A$  is called \_\_\_\_\_ and  $\omega$  is called \_\_\_\_\_. What is the relationship between  $\omega$  and the time period  $T$  of the same harmonic motion?

- 7) Complete the two figures below with the graphs that show the velocity ( $v$ ) of light propagating in vacuum as a function of time.

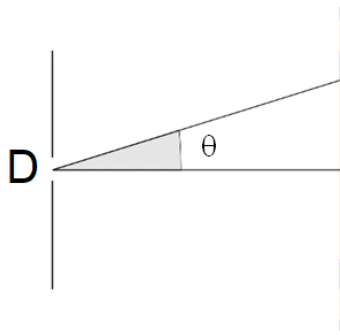


### TOPIC 3

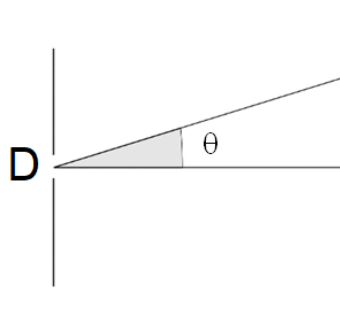
- 1) What is the definition of wavefront of monochromatic electromagnetic radiation emitted by a point source? Provide the definition in words.
- 2) What is the definition of frequency and wavelength of monochromatic electromagnetic radiation? Provide the definition in words.
- 3) What is the frequency of an electromagnetic wave propagating in a vacuum with a wavelength of 600 nm? Provide the numerical value and its unit of measurement.
- 4) A monochromatic electromagnetic wave propagates in a vacuum with a wavelength of 600 nm. What is its propagation velocity? Provide the numerical value and its unit of measurement. Calculate its wavelength and velocity in the case the same radiation propagates in a transparent glass with a refractive index of 1.5. Provide the numerical values of its wavelength and its velocity and their units of measurement.



- 5) Consider a source emitting electromagnetic radiation with a wavelength of 600 nm. This radiation (coming from the left in the figure) propagates through vacuum and strikes a screen with two rectangular slits in the experimental configuration of the famous Thomas Young's experiment on light interference. Assume that the length of segment  $\Delta$  in the figure is 300 nm. Continuing their path to the right to an infinite distance from S, will the two rays indicated by R1 and R2 interfere constructively or destructively? Why?



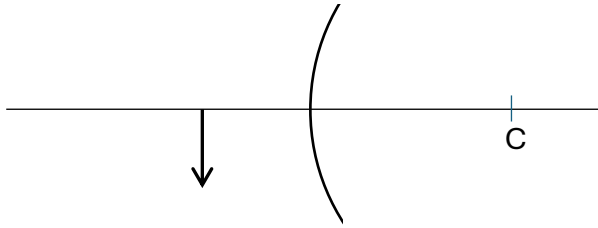
6) Consider a source emitting electromagnetic radiation with a wavelength of 600 nm. This radiation (coming from the left in the figure) propagates through vacuum and hits a screen where there is a rectangular slit of width  $D$ . The diffraction pattern observed on the screen to the right shows a central maximum with an angular half-width such that  $\sin(\theta) = 1/10$ . What is the width  $D$  of the slit? Provide the numerical value and the unit of measurement.



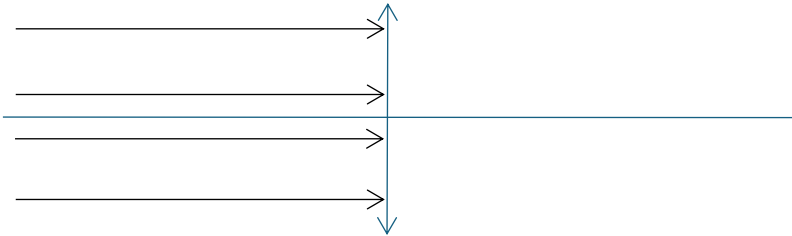
7) Consider a source emitting visible electromagnetic radiation. This radiation (coming from the left in the figure) strikes a screen on the right where there is a circular aperture of diameter  $D$ . Delete two of the three capitalized words in the following sentence so that the sentence is correct: the angular width ( $2\theta$ ) of the central maximum of the diffraction pattern on the screen for the blue component of light is LESS / EQUAL / GREATER than the red component.

#### TOPIC 4

- 1) In paraxial approximation, what is the focal length (numerical value and unit of measurement) of a thin lens with a power of +5 diopters? Please provide the numerical value and its unit of measurement.
- 2) In an optotype table for visual analyses, the height of a character subtends an angle equal to 5 sixtieths of a degree ( $5/60$  of a degree) at the eye of an observer. What value of visual acuity corresponds to the character expressed as a fraction of Snellen?
- 3) The prismatic power of an optical prism (glass prism surrounded by air) was measured using a ray of monochromatic light with a wavelength of 630 nm. Would the same prism have the same prismatic power if the incident light has a wavelength of 450 nm?
- 4) Through a schematic drawing in paraxial approximation in the framework of the basic geometrical optics, show the graphical construction of the image produced by a concave spherical mirror (with the mirrored part inside the spherical surface) for an extended object (an arrow) located at the mirror's focal point (object distance =  $s$ ; focal length =  $f$ ;  $s = f$ )



5) Through a schematic drawing in paraxial approximation in the framework of the basic geometrical optics, show the graphical construction of the image produced by a convex spherical mirror in the figure (with the mirrored part on the outer side of the sphere) in the case where the real object is represented by the arrow on the left. Is the image real and/or virtual?



6) Through a schematic drawing in the framework of the basic geometrical optics, explain the concept of spherical aberration of a thin positive lens. Light rays coming from the left are indicated by arrows in the figure.

- 7) Show the graphical construction in paraxial approximation in the framework of the basic geometrical optics of the virtual image produced by a Keplerian telescope of an extended object (an arrow) positioned infinitely far from the telescope. Where and at what distance from the telescope is this virtual image located?

## TOPIC 5

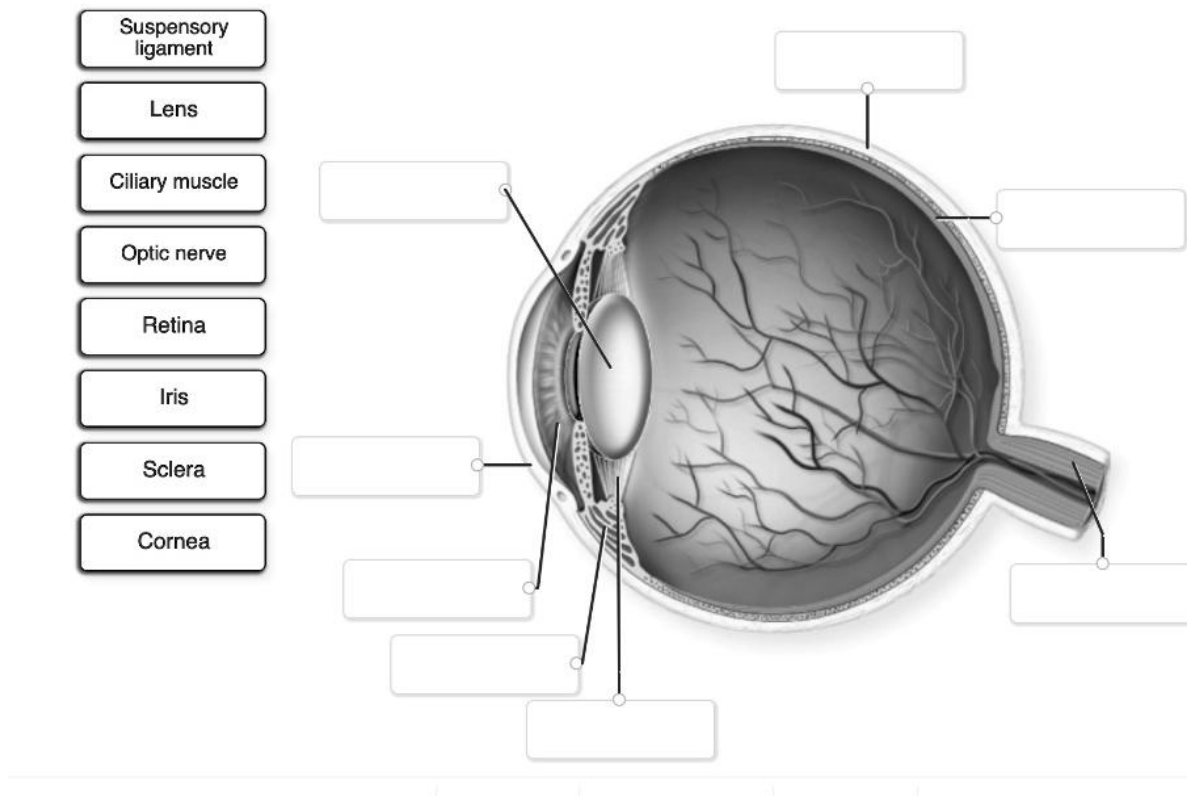
- 1) Read the following statements about the accommodation of the human eye. Choose the correct word from the options provided in parentheses.
  - a. Accommodation is the process by which the eye adjusts its (shape/color) to focus on objects at different distances.
  - b. For distant objects, the ciliary muscles (contract/relax) making the lens (thicker/thinner).
  - c. When focusing on a distant object, the suspensory ligaments of the eye become (tighter/looser).
  - d. Presbyopia/Myopia is the condition where the eye cannot properly accommodate, leading to difficulty in seeing nearby object.
  - e. Accommodation is controlled by the (autonomic/somatic) nervous system.
- 2) Where does the optic nerve begin and end? Its course is commonly divided into four parts, which ones?
 

Begin: \_\_\_\_\_

End: \_\_\_\_\_

Four parts: \_\_\_\_\_; \_\_\_\_\_; \_\_\_\_\_; \_\_\_\_\_
- 3) What are the extrinsic muscles of the eye and what are their functions? List the six extrinsic eye muscles and describe their roles in eye movement.
- 4) What are saccades in the vision process? Explain the typical speed and duration of saccades.
- 5) What are eye floaters also called "muscae volitantes" and where can they be found?

- 6) The cornea is an optically transparent, multilayered structure consisting of three cell layers and two membranes. Name them. Which layer forms 75-90% of the cornea's total thickness? How thick is it?
- 7) Please label the following structures of the human eye:



## TOPIC 6

- Write in plus-cylinder transposition, the following minus-cylinder prescription (D: diopters):  
 Sph -2.00 D      cyl -1.00 D      ax 180°  
 Sph \_\_\_\_\_ cyl \_\_\_\_\_ ax \_\_\_\_\_
- Convert in spherocylindrical transposition, the following bicylindrical prescription (D: diopters):  
 Cyl 1: +2.00 D ax 90°; Cyl 2: +1.00 D ax 180°  
 Sph \_\_\_\_\_ cyl \_\_\_\_\_ ax \_\_\_\_\_
- Write Prentice's rule which is used to determine the prismatic effect ( $\delta$ ) in prism dioptres ( $\Delta$ ) at a certain displacement from the optical centre of a lens ( $h$ ), measured in cm, of a lens with an optical power  $\Phi$  (in diopters).  

$$\delta =$$
- Determine the prismatic effect (prism dioptres and base) at a point which lies 10 mm above the optical centre of a lens of -6.00 diopters?

- 5) What is the prismatic effect (prism dioptres and base) at a point which lies 10 mm below the optical centre of a lens of Sph -2.00 diopters, cyl -2.00 diopters, ax 180°?
- 6) Describe the sixteenth-of-a-mm rule that affects the accuracy of manual interpupillary measurement performed by an examiner with a simple ruler (eye-to-eye or Viktorin method).
- 7) What is the typical position of the base of the thinning prism incorporated in a positive progressive addition lens and why it is incorporated in these ophthalmic lenses?

## TOPIC 7

- 1) Which is the ocular biometric parameter with the highest correlation to the refractive error?
  - ☐ Corneal Power
  - ☐ Lens Power
  - ☐ Anterior chamber depth
  - ☐ Axial length
- 2) Calculate the position of the far-point (*punctum remotum*) of a non-accommodate myopic eye with myopia of -3.00 diopters.
- 3) List the main components of accommodation.
- 4) Calculate the amplitude of accommodation of an uncorrected myopic eye with myopia of -1.00 diopter which has the nearest point of focusing at 20 cm.
- 5) List the main differences between the Push-Up and Minus-lens methods to measure the amplitudes of accommodation.
- 6) Define the Panum's space.
- 7) What is the stereoacuity threshold (foveal) of people with normally developed binocular vision?
- 8) What is the difference between static and dynamic retinoscopy in terms of what they can measure and how they are performed?
- 9) Describe one method to perform binocular balancing during a subjective refraction.
- 10) Describe one subjective method of measurement of heterophoria.
- 11) What is the difference between cover/uncover test, alternating cover test, and subjective cover test?
- 12) What is the Hering law?
- 13) What are the six cardinal positions of gaze and why they are useful in measuring the ocular motility?
- 14) Describe the main differences between the geometrical parameters of soft and rigid (corneal) contact lenses, such as Back Optic Zone Radius (BOZR), Total Diameter (TD), etc..
- 15) What is the conic section that best describe the corneal profile in any meridian?

- 16) What is the difference between sagittal and tangential algorithms to determine the corneal profile by computerized videokeratoscopy?
- 17) What is the LARS - Left Add, Right Subtract rule (or CAAS – Clockwise Add, Anti-clockwise Subtract) to determine the new axes of a toric soft contact lens that rotates in an unwanted position?
- 18) Describe the main differences in visual performances between monovision and multifocal contact lenses to correct a presbyopic subject.