

# Integrated Navigation Test 2 Practice (Sample)

## Study Guide



**Everything you need from our exam experts!**

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# Introduction

Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.

This guide was designed to help you do exactly that.

Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.

The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:

- Practice answering questions under realistic conditions,
- Improve accuracy and speed,
- Review explanations to strengthen weak areas, and
- Approach the exam with greater confidence.

We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.

**Remember:** successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.

Let's begin.

# How to Use This Guide

**This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:**

## **1. Start with a Diagnostic Review**

**Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.**

## **2. Study in Short, Focused Sessions**

**Break your study time into manageable blocks (e.g. 30 - 45 minutes). Review a handful of questions, reflect on the explanations.**

## **3. Learn from the Explanations**

**After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.**

## **4. Track Your Progress**

**Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.**

## **5. Simulate the Real Exam**

**Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.**

## **6. Repeat and Review**

**Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.**

**There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!**

## Questions

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- 1. An ARPA Target is displayed on an ECDIS screen as which symbol?**
  - A. Circle**
  - B. Square**
  - C. Triangle**
  - D. Diamond**
  
- 2. Which data interface is a high-reliability avionics data bus used to transport navigation data like position, velocity, and attitude?**
  - A. NMEA 0183.**
  - B. NMEA 2000.**
  - C. ARINC 429/664.**
  - D. CANopen.**
  
- 3. How do you handle GNSS outages in INS/GNSS integration?**
  - A. Rely on INS for short-term dead reckoning, use integrity monitors, switch to tightly- or loosely-coupled fusion with alternative aiding sensors, and adjust filter noise to reflect increased uncertainty.**
  - B. Turn off system and stop navigation**
  - C. Ignore outages and continue with no updates**
  - D. Replace GNSS with WiFi trilateration**
  
- 4. What best describes the selection of appropriate and unambiguous data on the ECDIS?**
  - A. Data should be updated every 24 hours**
  - B. The display should be relevant to the navigational task at hand so as to avoid clutter**
  - C. Display should include all data regardless of relevance**
  - D. Display should be monochrome for clarity**

5. A 700 LOA containership with a forward house and bridge located 60 from the circle on the chart and ECDIS. What is the radius of the swing circle?
- A. 700 ft
  - B. 900 ft
  - C. 1150 ft
  - D. 1300 ft
6. Which statements best describe the frames used in integrated navigation and how they relate?
- A. Body frame attached to the vehicle; navigation frame anchored to Earth's surface; and Earth frame fixed to Earth; transformations between them use rotation matrices.
  - B. Body frame attached to the vehicle; navigation frame fixed to the Sun; Earth frame fixed to the planets.
  - C. Body frame attached to the vehicle; navigation frame defined in inertial space; Earth frame rotating with Earth.
  - D. Body frame at the Earth's center; navigation frame on the Moon; Earth frame fixed to Jupiter.
7. Describe the WGS84, ECEF, and ENU coordinate systems, and how do you convert between them?
- A. WGS84 is the global geodetic datum; ECEF is Earth-centered, Earth-fixed Cartesian coordinates; ENU is local East-North-Up coordinates. Conversions involve geodetic-to-ECEF transforms and rotation/translation using a reference location.
  - B. WGS84 is the local frame; ECEF is a geodetic lat/lon; ENU is a fixed body frame.
  - C. WGS84 and ENU are identical; ECEF is unrelated.
  - D. Conversions do not require a reference location.
8. Describe the process for handling outlier GNSS measurements within a Kalman filter?
- A. Apply residual-based gating (e.g., chi-square test); reject measurements that exceed a threshold; re-run the update with remaining measurements.
  - B. Always include all measurements regardless of residuals.
  - C. Increase the process noise to absorb outliers.
  - D. Remove INS data and rely solely on GNSS.

**9. A transducer with a dual axis Janus configuration allows for speed calculation in which of the following?**

- A. One direction**
- B. Two directions**
- C. Both directions**
- D. All of the above**

**10. How does the EKF differ from the UKF in navigation applications?**

- A. UKF uses the unscented transform; EKF uses linearization.**
- B. EKF uses first-order linearization; UKF uses the unscented transform.**
- C. EKF and UKF are identical in how they handle nonlinearity.**
- D. EKF uses second-order Taylor expansion; UKF uses stochastic sampling.**

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## Answers

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1. A
2. C
3. A
4. B
5. C
6. A
7. A
8. A
9. D
10. B

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## **Explanations**

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**1. An ARPA Target is displayed on an ECDIS screen as which symbol?**

- A. Circle**
- B. Square**
- C. Triangle**
- D. Diamond**

An ARPA target is a tracked radar contact, and the standard display choice for such a moving target on an ECDIS screen is a circle. The circle provides a clear, unambiguous marker that stays legible as scale changes and contrast varies, signaling a dynamic contact that ARPA/MARPA is actively tracking. It distinguishes the target from fixed chart features and from the own-ship symbol, which helps the navigator quickly assess potential collision or crossing situations. Other shapes are reserved for different object types or chart elements, so the circle is the most appropriate and recognizable symbol for a tracked ARPA target.

**2. Which data interface is a high-reliability avionics data bus used to transport navigation data like position, velocity, and attitude?**

- A. NMEA 0183.**
- B. NMEA 2000.**
- C. ARINC 429/664.**
- D. CANopen.**

Navigation data in aircraft need to move with strict reliability and predictable timing. ARINC 429 and ARINC 664 are designed exactly for that role in aviation networks. ARINC 429 provides a structured, standardized way to send navigation-related data as 32-bit words over a dedicated bus, with provisions for redundancy and deterministic delivery so position, velocity, and attitude information arrives where it's needed without ambiguity. ARINC 664 takes this forward with Avionics Full-Duplex Switched Ethernet, offering higher data rates and robust, fault-tolerant networking suitable for modern, avionics-wide data sharing. The other interfaces are not typically used as the high-reliability nav data bus in aviation. NMEA 0183 and NMEA 2000 originated for marine use and are slower or not certified for certified aircraft networks. CANopen is a general-purpose fieldbus not specialized for aviation's stringent reliability and real-time requirements.

### 3. How do you handle GNSS outages in INS/GNSS integration?

- A. Rely on INS for short-term dead reckoning, use integrity monitors, switch to tightly- or loosely-coupled fusion with alternative aiding sensors, and adjust filter noise to reflect increased uncertainty.**
- B. Turn off system and stop navigation**
- C. Ignore outages and continue with no updates**
- D. Replace GNSS with WiFi trilateration**

When GNSS outages occur, the goal is to keep navigation going by leaning on the INS for a short time and treating GNSS as unreliable rather than discarded. Start by using the inertial sensors to provide continuous pose updates (dead reckoning), since they keep supplying data even without GNSS. At the same time, run integrity monitors to assess GNSS health and detect faults or degraded signals so the system doesn't trust bad measurements. If GNSS is unavailable or degraded, switch the fusion strategy to incorporate alternative aiding sensors that are still available. This can include other sources such as Doppler and acceleration data from the INS, barometric altitude, visual or lidar/structure-based cues, wheel odometry, or map information. The idea is to use whatever reliable measurements are on hand to constrain the INS drift and maintain a reasonable estimate of position and attitude. Crucially, adjust the filter to reflect increased uncertainty. inflate the measurement and process noise to prevent over-reliance on GNSS-like updates that aren't trustworthy, allowing the estimator to naturally rely more on inertial and aiding sensors during the outage. This approach yields a graceful degradation of navigation performance rather than a sudden loss of accuracy.

### 4. What best describes the selection of appropriate and unambiguous data on the ECDIS?

- A. Data should be updated every 24 hours**
- B. The display should be relevant to the navigational task at hand so as to avoid clutter**
- C. Display should include all data regardless of relevance**
- D. Display should be monochrome for clarity**

Managing what you display on the ECDIS focuses on showing only data that matters for the current navigational task, so the screen stays clear and the information remains unambiguous. By filtering layers and highlighting what's relevant for the leg you're planning or executing, you can quickly interpret hazards, bearings, depths, and aids to navigation without wading through irrelevant details. This targeted display reduces cognitive load and the chance of misreading information under pressure. For example, when approaching a channel, you would enable the depth, hazards, aids to navigation, and your planned route, while temporarily hiding unrelated overlays. The goal is to keep the presentation concise and task-specific, not to overwhelm the screen with everything that exists on the chart. Frequency of data updates matters for accuracy, but it doesn't address how you choose what to show; including all data regardless of relevance would create clutter, and monochrome rendering isn't about data selection.

5. A 700 LOA containership with a forward house and bridge located 60 from the circle on the chart and ECDIS. What is the radius of the swing circle?
- A. 700 ft
  - B. 900 ft
  - C. 1150 ft**
  - D. 1300 ft

Swing circle radius is the distance from the turning center (the circle) to the farthest point of the vessel as it swings. In this scenario, the containership is 700 ft long and its forward house/bridge sits 60 ft from the turning center. To capture the full reach of the vessel during a swing, you must account for the ship's length plus that forward offset, which results in a radius of 1150 ft. That is why the correct choice is 1150 ft.

6. Which statements best describe the frames used in integrated navigation and how they relate?
- A. Body frame attached to the vehicle; navigation frame anchored to Earth's surface; and Earth frame fixed to Earth; transformations between them use rotation matrices.**
  - B. Body frame attached to the vehicle; navigation frame fixed to the Sun; Earth frame fixed to the planets.
  - C. Body frame attached to the vehicle; navigation frame defined in inertial space; Earth frame rotating with Earth.
  - D. Body frame at the Earth's center; navigation frame on the Moon; Earth frame fixed to Jupiter.

In integrated navigation you work with frames that are tied to different physical references and relate them through rotations (and, if needed, translations). The body frame is fixed to the vehicle, so its axes move with the craft and align with its forward, side, and down directions. The navigation frame is a local frame anchored to the Earth's surface, often a north-east-down or similar local level frame, so its origin stays on the ground and its orientation follows the Earth's surface locally. The Earth frame is fixed to Earth and rotates with it, aligning with the Earth-centered, Earth-fixed system. Transforming quantities between these frames relies on rotation matrices (direction cosine matrices) to account for the changing orientation between frames. This setup—body frame tied to the vehicle, a Earth-surface-anchored navigation frame, and an Earth-fixed frame that rotates with Earth—is the standard way frames are described in integrated navigation. The other options introduce frames tied to the Sun, planets, or distant bodies, which aren't used for practical, local navigation references.

7. Describe the WGS84, ECEF, and ENU coordinate systems, and how do you convert between them?

**A. WGS84 is the global geodetic datum; ECEF is Earth-centered, Earth-fixed Cartesian coordinates; ENU is local East-North-Up coordinates. Conversions involve geodetic-to-ECEF transforms and rotation/translation using a reference location.**

**B. WGS84 is the local frame; ECEF is a geodetic lat/lon; ENU is a fixed body frame.**

**C. WGS84 and ENU are identical; ECEF is unrelated.**

**D. Conversions do not require a reference location.**

The idea is to understand how these three coordinate systems relate and how to move between them. WGS84 defines a global reference frame: it's a geodetic datum that specifies the shape of the Earth as an ellipsoid and a standard orientation in space. In this frame you typically express positions with geodetic latitude, longitude, and height above the ellipsoid. To work in a simple, global Cartesian form, those geodetic coordinates are transformed to Earth-centered, Earth-fixed (ECEF) coordinates, where the origin is the Earth's center and the axes are tied to the Earth's rotation (X toward the intersection of the equator and prime meridian, Y toward 90 degrees East, Z toward the North Pole). The local ENU frame is a different idea: it's a small, local tangent plane at a specific reference location, with axes pointing East, North, and Up. It's used for measurements in the vicinity of that point because distances and directions are most intuitive there. Converting between them usually follows this path: start with geodetic coordinates in WGS84 (latitude, longitude, height) and convert to ECEF using the ellipsoid parameters (semi-major axis and eccentricity) of WGS84. Then, if you need local coordinates, pick a reference location, compute its ECEF coordinates, form the rotation that aligns the ECEF axes with the ENU axes at that reference point, subtract the reference ECEF position, and apply that rotation. The inverse process is used to go from ENU back to ECEF and then to geodetic coordinates. The ENU frame depends on a reference location, so you can't define ENU without one. This is why the described set of statements is correct: WGS84 is a global geodetic datum, ECEF are Earth-centered, Earth-fixed Cartesian coordinates, ENU is a local East-North-Up frame, and conversions involve a geodetic-to-ECEF transform plus a rotation/translation tied to a reference location.

**8. Describe the process for handling outlier GNSS measurements within a Kalman filter?**

- A. Apply residual-based gating (e.g., chi-square test); reject measurements that exceed a threshold; re-run the update with remaining measurements.**
- B. Always include all measurements regardless of residuals.**
- C. Increase the process noise to absorb outliers.**
- D. Remove INS data and rely solely on GNSS.**

When fusing GNSS data in a Kalman filter, you want the update to be driven by measurements that fit what the filter already predicts. Outliers produce large residuals, which can badly bias the state if they're treated like normal measurements. The reliable way to handle this is to test each measurement against the predicted innovation. Compute the residual between what the filter expects and what GNSS reports, and compare its squared Mahalanobis distance to a chi-square threshold based on the measurement dimension. If the residual is too large, that measurement is flagged as an outlier and rejected. After removing the bad measurements, you re-run the update with the remaining data. This keeps the state estimate consistent and accurate by preventing a single dubious measurement from skewing the result. Choosing this approach over always including all measurements preserves integrity; simply cranking up process noise to absorb outliers degrades accuracy and undermines the model. Relying solely on GNSS while discarding INS data removes valuable information that the fused system would otherwise use, reducing robustness rather than addressing the outliers themselves.

**9. A transducer with a dual axis Janus configuration allows for speed calculation in which of the following?**

- A. One direction**
- B. Two directions**
- C. Both directions**
- D. All of the above**

A dual-axis Janus transducer gives you two independent measurement channels, each aligned to its own axis. That means you can resolve velocity components along both axes. If you only need speed in a single direction, you can use the measurement from one axis. If you want speed along two directions, you use both axes to get the two components. And by combining the two components, you can determine the overall speed and its direction in the plane defined by the axes, effectively covering all directions. So this setup supports calculating speed in a single direction, in two directions, or in all directions, making all of the above possible.

**10. How does the EKF differ from the UKF in navigation applications?**

- A. UKF uses the unscented transform; EKF uses linearization.**
- B. EKF uses first-order linearization; UKF uses the unscented transform.**
- C. EKF and UKF are identical in how they handle nonlinearity.**
- D. EKF uses second-order Taylor expansion; UKF uses stochastic sampling.**

In navigation applications, the main idea being tested is how nonlinear models are handled in state estimation. The EKF relies on a first-order linearization of the nonlinear process and measurement models around the current state estimate, obtained via Jacobians. This makes the filter behave as if the system were linear on that local neighborhood, but it can introduce errors when the true state is far from the estimate or when the nonlinearities are strong. The UKF takes a different route: it uses the unscented transform. It selects a small set of sigma points that represent the state distribution, propagates all of them through the actual nonlinear functions, and then recomputes the mean and covariance from the transformed points. This approach captures nonlinear effects more accurately without needing explicit Jacobians. In practice, that often yields better estimates for nonlinear sensing and motion models common in navigation, at the cost of more computations. So the best description is that the EKF uses first-order linearization, while the UKF uses the unscented transform. The other phrasing either oversimplifies or mischaracterizes how the UKF operates (namely, that it relies on stochastic sampling or that EKF uses higher-order expansions).

## Next Steps

**Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.**

**As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.**

**If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at [hello@examzify.com](mailto:hello@examzify.com).**

**Or visit your dedicated course page for more study tools and resources:**

**<https://integratednav2.examzify.com>**

**We wish you the very best on your exam journey. You've got this!**

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