SOA Fundamentals of Actuarial Mathematics (FAM) Practice Test (Sample)

Study Guide

BY EXAMZIFY

Everything you need from our exam experts!

Table of Contents

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

1. **With a franchise deductible D and deductible amount d, the expected value of Y under a super policy is E[X] - E[min(X, D)] + d*S(d).**
   - A. E[X] - E[min(X, D)] + d*S(d)
   - B. E[X] - E[min(X, D)]
   - C. E[X] + d*S(d)
   - D. E[X] - d*S(d)

2. **If X ~ Normal(mu, sigma^2) and Y = cX, what is the distribution of Y?**
   - A. Normal(mu, c^2 sigma^2)
   - B. Normal(c mu, (c sigma)^2)
   - C. Lognormal(mu, sigma^2)
   - D. Beta distribution

3. **Parallelogram method: which sequence describes the pricing steps?**
   - A. Determine timing and amount of rate changes; calculate cumulative rate level index for each rate group; calculate portion of premium in each square; calculate the weighted average factor for each year; calculate the on level factor; use on level factor to reprice that year's premium
   - B. Determine timing only; compute cumulative rate changes; weigh premium per square; reprice
   - C. Determine rate changes; set final factor; reprice; compute weighted factor; compute index
   - D. None of the above

4. **Renewable term insurance allows you to purchase another term at the end without proving your health status.**
   - A. True
   - B. False
   - C. Not specified
   - D. Depends on underwriting

5. What does a standard fire policy cover?

A. Fire or lightning damage

B. Flood damage

C. Earthquake damage

D. Theft

6. Under a constant force of mortality with force mu and force of interest delta, what is A_x?

A. mu/(mu+delta)

B. delta/(mu+delta)

C. mu/delta

D. (mu+delta)/mu

7. Which statement about the base of (blah/(x+blah))^20 is true?

A. The base is always positive.

B. The base is always negative.

C. The base is always nonzero.

D. The base can be zero or nonzero depending on blah and x.

8. In Black-Scholes, what does volatility represent?

A. The standard deviation of the log-returns

B. The variance of the log-returns

C. The mean of the log-returns

D. The drift term in the stock price process

9. Which expression gives the full credibility for claims nc?

A. nc = ((z_{1+p/2}) / k)^2 * (CV of N)^2

B. nc = ((z_{1+p/2}) / k)^2 * (Variance(N) / E[N] * (CV of X)^2)

C. nc = ((z_{1+p/2}) / k)^2 * (Variance(N) / E[N] + (CV of X)^2)

D. nc = ((z_{1+p/2}) / k)^2 * (Variance(N) / E[N] - (CV of X)^2)

10. When the death benefit is equal to the policy value, what technique can help determine the premium P?

A. Use a numerical integration technique

B. Use a recursive formula to derive two expressions for P

C. Solve via Monte Carlo simulation

D. Apply a closed-form using Laplace transforms

Answers

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

Explanations

1. **With a franchise deductible D and deductible amount d, the expected value of Y under a super policy is E[X] - E[min(X, D)] + d*S(d).**

   A. E[X] - E[min(X, D)] + d*S(d)

   B. E[X] - E[min(X, D)]

   C. E[X] + d*S(d)

   D. E[X] - d*S(d)

The key idea is how the payout under this super policy breaks down and how to take expectations of those parts. The policy pays the amount by which a claim exceeds the franchise D, whenever X > D. That part is (X − D)+, where (·)+ means max with 0. It also pays an extra fixed amount d whenever the claim exceeds d, which contributes d times the probability that X > d (i.e., d·S(d)). So the total expected payout is E[(X − D)+] + d·P(X > d). Use the identity (X − D)+ = X − min(X, D) to get E[(X − D)+] = E[X] − E[min(X, D)]. Let S(d) denote P(X > d). Put these together: E[Y] = E[X] − E[min(X, D)] + d·S(d). This matches the given expression, since E[X] is the mean claim, subtracting E[min(X, D)] removes the part up to the franchise, and the term d·S(d) adds the extra fixed payment when the claim exceeds d.

2. **If X ~ Normal(mu, sigma^2) and Y = cX, what is the distribution of Y?**

   A. Normal(mu, c^2 sigma^2)

   B. Normal(c mu, (c sigma)^2)

   C. Lognormal(mu, sigma^2)

   D. Beta distribution

Scaling a normal variable by a constant preserves normality, with its mean and variance scaled accordingly. If X ~ N(mu, sigma^2) and Y = cX, then E[Y] = c mu and Var[Y] = c^2 sigma^2. So Y ~ N(c mu, c^2 sigma^2), which is the same as Normal(c mu, (c sigma)^2). This follows from the standardization approach: (Y − c mu)/(c sigma) = (X − mu)/sigma ~ N(0,1). The other options don’t fit this linear transformation—a lognormal arises from exponentiating a normal, and a beta distribution comes from different processes.

3. Parallelogram method: which sequence describes the pricing steps?

A. Determine timing and amount of rate changes; calculate cumulative rate level index for each rate group; calculate portion of premium in each square; calculate the weighted average factor for each year; calculate the on level factor; use on level factor to reprice that year's premium

B. Determine timing only; compute cumulative rate changes; weigh premium per square; reprice

C. Determine rate changes; set final factor; reprice; compute weighted factor; compute index

D. None of the above

This question focuses on how the parallelogram method structures pricing changes over time. The method builds a pricing path by tracking when and by how much rates change, then translating those changes into a geometric layout that weights portions of the premium accordingly. You start by identifying the timing and magnitude of rate changes, because every later step depends on these changes. Next, you compute the cumulative rate-level index for each rate group, which means finding the overall rate factor up to each point in time for that segment. Then you determine how much of the premium belongs to each square of the parallelogram, effectively allocating the premium across the different rate-change intervals. With those portions, you form a weighted average factor for each year, reflecting how the varying rate changes affect the year's premium. The on-level factor is then derived to ensure the premium aligns to a level target after applying the rate changes. Finally, you apply this on-level factor to reprice that year's premium, obtaining a consistent, level premium across years. This sequence is essential because it preserves the proper influence of each rate-change interval on the overall price and results in a correctly levelized premium. Other options skip or reorder these steps, such as omitting the cumulative rate-level index or failing to allocate premium portions to the parallelogram squares, which would lead to incorrect pricing.

4. Renewable term insurance allows you to purchase another term at the end without proving your health status.

A. True

B. False

C. Not specified

D. Depends on underwriting

The concept being tested is whether renewing a term policy always happens without any medical underwriting. Renewable term means you have the option to extend the coverage for another term, but whether you must prove your health at renewal is not guaranteed. The specifics depend on the contract: some policies do require underwriting or health information at renewal, while others offer guaranteed renewal or no-exam renewals only under certain conditions. Because the need for health evidence at renewal varies by policy, the statement that renewal can always be done without proving health status is not universally true.

5. What does a standard fire policy cover?

A. Fire or lightning damage

B. Flood damage

C. Earthquake damage

D. Theft

A standard fire policy is designed to cover direct damage caused by fire, including damage from lightning. That is the peril it protects against in its basic form. It does not automatically cover other risks like floods, earthquakes, or theft; those perils require an endorsement or a separate policy. So the best answer is that it covers fire or lightning damage, while the other options would need additional coverage beyond the standard fire policy.

6. Under a constant force of mortality with force mu and force of interest delta, what is A_x?

A. mu/(mu+delta)

B. delta/(mu+delta)

C. mu/delta

D. (mu+delta)/mu

Under a constant force of mortality μ, the probability density of dying at time t after age x is μ e^{-μ t}, and the discount factor for time t is e^{-δ t}. The present value of a unit death benefit paid at time t is e^{-δ t}, so the expected present value is the integral over all future times of these components: ∫_0^∞ e^{-δ t} μ e^{-μ t} dt = μ ∫_0^∞ e^{-(μ+δ) t} dt = μ/(μ+δ). Therefore, A_x = μ/(μ+δ).

7. Which statement about the base of (blah/(x+blah))^20 is true?

A. The base is always positive.

B. The base is always negative.

C. The base is always nonzero.

D. The base can be zero or nonzero depending on blah and x.

The base is the fraction blah divided by (x plus blah). Its value can vary depending on the actual values of blah and x; it is not fixed to be always positive or always negative. If blah is zero (and the denominator isn't zero), the base is zero, so the whole expression becomes zero after raising to the 20th power. If blah and x have the same sign relative to the denominator, the base can be positive; if they have opposite signs, the base can be negative. Since the denominator could be zero for some (blah, x) values, the base is undefined there as well, but within the domain where it's defined, the base can be zero or a nonzero number. Thus the only statement that correctly captures this variable possibility is that the base can be zero or nonzero depending on blah and x.

8. In Black-Scholes, what does volatility represent?

A. The standard deviation of the log-returns

B. The variance of the log-returns

C. The mean of the log-returns

D. The drift term in the stock price process

Volatility is the standard deviation of the log-price changes (log-returns) in the model. In geometric Brownian motion, the stock price follows dS/S = μ dt + σ dW. Using Ito's lemma, the log-price evolves as d log S = (μ − σ^2/2) dt + σ dW, so over a short period Δt the log-return has a variance of σ^2 Δt and a standard deviation of σ√Δt. The parameter σ is therefore the instantaneous standard deviation per unit time, i.e., the volatility. The mean of log-returns depends on μ (specifically (μ − σ^2/2)Δt), not on volatility; the variance is σ^2 Δt, which is related but not the volatility itself; and the drift term is μ, the expected rate of return, not the volatility.

9. Which expression gives the full credibility for claims nc?

A. nc = ((z_{1+p/2}) / k)^2 * (CV of N)^2

B. nc = ((z_{1+p/2}) / k)^2 * (Variance(N) / E[N] * (CV of X)^2)

C. nc = ((z_{1+p/2}) / k)^2 * (Variance(N) / E[N] + (CV of X)^2)

D. nc = ((z_{1+p/2}) / k)^2 * (Variance(N) / E[N] - (CV of X)^2)

The idea being tested is that full credibility for total claims takes into account all sources of variability that affect the total amount, not just one part. If the total in a period is T = sum of N claim sizes X_i, then the uncertainty in T comes from two independent places: how many claims occur (N) and how large each claim is (the X_i). To gauge credibility, you look at the relative variability of T, which combines these two factors additively because variances from independent sources add. Specifically, the variability contributed by the claim count is captured by Var(N) divided by E[N], reflecting how much N fluctuates relative to its mean. The variability contributed by the claim sizes is captured by the squared coefficient of variation of X, (CV of X)^2, since CV_X^2 = Var(X)/[E(X)]^2 measures dispersion of claim sizes around their mean. Adding these two components gives the total relative variability that credibility must compensate for when estimating the mean total claims. The factor ((z_{1+p/2})/k)^2 scales this total variability to the desired confidence level, with k representing the credibility parameter tied to the target precision and p. If N were Poisson, Var(N)/E[N] would be 1, giving a familiar form 1 + (CV of X)^2, reinforcing the interpretation that total variability is the sum of count variability and size variability. Other forms don't reflect the way independent sources of variability combine: they either mix terms multiplicatively or subtract one source, which would misrepresent total uncertainty and understate or overstate the required credibility.

10. When the death benefit is equal to the policy value, what technique can help determine the premium P?

A. Use a numerical integration technique

B. Use a recursive formula to derive two expressions for P

C. Solve via Monte Carlo simulation

D. Apply a closed-form using Laplace transforms

This uses a dynamic, time-evolving view of the policy value. If the death benefit equals the policy value, the reserve (policy value) at each moment follows a simple update that includes the premium, the investment return, and the mortality event. By writing this update one step at a time, you can obtain two separate expressions for the premium P: one by unfolding the recursion forward from the start, and another by stepping backward from the known boundary condition where the payout equals the policy value. Since both expressions must describe the same P, you can set them equal and solve for P directly. This recursive (dynamic) approach leverages the structure of how the policy value grows and is paid out, making the premium determination straightforward under the D = V condition. Other methods would either simulate outcomes (Monte Carlo), require heavy numerical integration, or rely on special transforms that aren't as naturally aligned with the one-step reserve dynamics when D = V. The recursive tactic directly exploits the time-evolution of the policy value to isolate P.

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.

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

https://soafam.examzify.com

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