

 **ACTEX Learning**

EA-1 Exams & Solutions

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An EA Exam



Actuarial & Financial Risk Resource Materials
Since 1972

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May 2022 EA-1 Examination**CONDITIONS GENERALLY APPLICABLE TO ALL EA-1 EXAMINATION QUESTIONS**

If applicable, the following conditions should be considered a part of the data for each question, unless otherwise stated or implied.

- (1) The normal retirement age is 65.
- (2) Retirement pensions commence at normal retirement age and are paid monthly for life at the beginning of each month.
- (3) There are no pre-retirement death or disability benefits.
- (4) Actuarial equivalence is based on the mortality table and interest rate assumed for funding purposes.
- (5) Interest rates that are compounded more frequently than annually are expressed as nominal rates.
- (6) Where multiple lives are involved, future lifetimes are assumed to be independent of each other.
- (7) The term “gross single premium” is equivalent to “contract single premium;” the term “net single premium” is equivalent to “single benefit premium;” the term “gross annual premium” is equivalent to “annual contract premium;” the term “net annual premium” is equivalent to “annual benefit premium.”
- (8) There are no policy loans in effect.
- (9) For a bond, the face amount and the redemption value are the same.
- (10) Interest rate equals yield rate.
- (11) The term “duration” means “Macaulay duration”.

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Data for Question 1 (3 points)

A table of $s_{\overline{n}|}$ at 5.0% is to be constructed on a computer using the following recursive formula:

$$\begin{aligned}s_{\overline{1}|} &= 1 \\ s_{\overline{n+1}|} &= 1.05s_{\overline{n}|} + 1 \quad n \geq 1\end{aligned}$$

However, an error occurred and the following incorrect recursive formula was used:

$$\begin{aligned}s_{\overline{1}|} &= 1 \\ s_{\overline{n+1}|} &= 1.05s_{\overline{n}|} + 0.1 \quad n \geq 1\end{aligned}$$

X = the value produced for $s_{\overline{20}|}$ using the incorrect recursive formula.

Question 1

In what range is X ?

- (A) Less than 5.60
- (B) 5.60 but less than 5.70
- (C) 5.70 but less than 5.80
- (D) 5.80 but less than 5.90
- (E) 5.90 or more

Data for Question 2 (3 points)

Selected annuity values:

$$\ddot{a}_{\overline{n+2}|} = 14.030$$

$$\ddot{s}_{\overline{n}|} = 52.344$$

X = the effective annual interest rate.

Question 2

In what range is X ?

- (A) Less than 5.00%
- (B) 5.00% but less than 5.25%
- (C) 5.25% but less than 5.50%
- (D) 5.50% but less than 5.75%
- (E) 5.75% or more

Data for Question 3 (3 points)

Terms of a perpetuity:

Frequency of payments	Annual, payable at the end of each year
Payment amounts	\$1 at the end of years 1, 4, 7, ...
	\$2 at the end of years 2, 5, 8, ...
	\$3 at the end of years 3, 6, 9, ...

Interest rate: 5.0% per year, compounded semiannually

X = the present value of the perpetuity.

Question 3

In what range is X ?

- (A) Less than \$25
- (B) \$25 but less than \$30
- (C) \$30 but less than \$35
- (D) \$35 but less than \$40
- (E) \$40 or more

Data for Question 4 (3 points)

Provisions of an annuity-immediate:

Periodic payment	\$150
Payment frequency	Quarterly
Term	5 years

Interest rate: 8.00% per year, compounded semi-annually

X = the present value of this annuity.

Question 4

In what range is X ?

- (A) Less than \$2,405
- (B) \$2,405 but less than \$2,455
- (C) \$2,455 but less than \$2,505
- (D) \$2,505 but less than \$2,555
- (E) \$2,555 or more

Data for Question 5 (4 points)

Terms of a loan:

Term	36 months
Repayments	Level monthly, payable at the end of each month
Interest rate	18.0% per year, compounded monthly

X = the ratio of cumulative interest repaid to cumulative principal repaid immediately following the 24th payment.

Question 5

In what range is X ?

- (A) Less than 0.40
- (B) 0.40 but less than 0.42
- (C) 0.42 but less than 0.44
- (D) 0.44 but less than 0.46
- (E) 0.46 or more

Data for Question 6 (3 points)

Terms of a loan:

Amount borrowed	\$10,000
Repayments	Level annual, payable at the end of each year
Interest rate	4.0% per year, compounded annually

The interest portion of the fourth payment is \$225.

X = the principal portion of the fourth payment.

Question 6

In what range is X ?

- (A) Less than \$1,225
- (B) \$1,225 but less than \$1,325
- (C) \$1,325 but less than \$1,425
- (D) \$1,425 but less than \$1,525
- (E) \$1,525 or more

Data for Question 7 (3 points)

Terms of a 10-year bond:

Face amount	\$1,000
Redemption amount	\$1,000
Coupon rate	4.0% per year, payable semi-annually
Yield rate	5.0% per year, compounded semi-annually

X = the total investment return to the purchaser over the lifetime of the bond.

Question 7

In what range is X ?

- (A) Less than \$350
- (B) \$350 but less than \$400
- (C) \$400 but less than \$450
- (D) \$450 but less than \$500
- (E) \$500 or more