

Number and algebra · supported focus

Supported focus · SL

Supported scope

- Supported SL focus. First assessment 2021; current through 2028.
First-assessment-2029 course is separate.. Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Number · 1.1

Reasoning

A supplier packs 72 pencils and 90 pens into identical gift bags. How can we avoid leftovers? This lesson studies prime factor : A prime number that divides the integer exactly.

Number · 2.1

Reasoning

Prime factors reveal shared structure. Use the smallest common prime powers for the HCF and the largest for the LCM. Estimate before calculating; use brackets to preserve the order of operations. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Number · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$a = \prod p_i^{\alpha_i}, \quad b = \prod p_i^{\beta_i}, \quad \text{HCF}(a, b) = \prod p_i^{\min(\alpha_i, \beta_i)}$$

Number · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Number · 3.3

Reasoning

$72 = 2^3 \times 3^2$ and $90 = 2 \times 3^2 \times 5$. Their HCF is $2 \times 9 = 18$. Make 18 bags with 4 pencils and 5 pens each. Their LCM is $2^3 \times 3^2 \times 5 = 360$.

Number · 4.1

Reasoning

The HCF divides both numbers; the LCM is a multiple of both. They answer different questions. A decimal estimate is not an exact fraction. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Number · 4.2

Reasoning

The HCF of two positive integers is always larger than either integer. This claim is false. Explain which definition or assumption it violates.

Number · 5.1

Reasoning

For a non-calculator paper, keep fractions exact and show cancellation. For a calculator paper, enter the full expression and compare with your estimate. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Number · 6.1

Reasoning

Current first-assessment-2021 Applications and Interpretation SL. This is authored concept support; the full guide is needed to certify every objective. Give the method before the final answer, and use the paper's calculator and formula rules. Review a wrong answer by locating the first invalid step.

Number · 6.2

Reasoning

A prime number that divides the integer exactly. Choose the relationship, show the method, check its assumptions and interpret the result.

Number · diagram

$$72 = 2^3 \times 3^2$$

$$90 = 2 \times 3^2 \times 5$$

$$\text{Shared smallest powers: } 2 \times 3^2 = 18$$

- Original teaching diagram: Exact arithmetic and estimation
- Use the labels and the stated model together.

Number · original transfer

Your turn

A supplier has 84 pencils and 126 pens. Find the greatest number of identical bags without leftovers and the contents of each; then explain why the LCM answers a different question.

Number · transfer reasoning

Method and interpretation

HCF=42, each bag 2 pencils and 3 pens. LCM=252 is a common multiple, useful for matching repeated quantities, not the greatest number of bags dividing both stocks.

Percent · 1.1

Reasoning

A coat is reduced by 20% to ¥240. The discount applies to the original price, not to the sale price. This lesson studies multiplier : A factor that performs a percentage change in one multiplication.

Percent · 2.1

Reasoning

A $p\%$ increase has multiplier $1+p/100$; a decrease has multiplier $1-p/100$. Reverse a percentage by dividing by the multiplier. In a ratio, first find the total number of parts. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Percent · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$P_{\text{new}} = P_{\text{old}} \left(1 + \frac{r}{100} \right)$$

Percent · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Percent · 3.3

Reasoning

Let the original price be P . The model is sale price $= 0.8P$. Hence $P = 240 / 0.8 = 300$. A later 20% increase gives $240 \times 1.2 = 288$, so the two changes do not cancel.

Percent · 4.1

Reasoning

A percentage uses a stated base. Subtracting the percentages loses that base. For compound change, multiply the multipliers; do not add the percentages. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Percent · 4.2

Reasoning

A 20% decrease followed by a 20% increase restores the starting price. This claim is false. Explain which definition or assumption it violates.

Percent · 5.1

Reasoning

For direct proportion use $y=kx$; for inverse proportion use $y=k/x$. Calculate k from a known pair before using a new value. State what you held constant. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Percent · 6.1

Reasoning

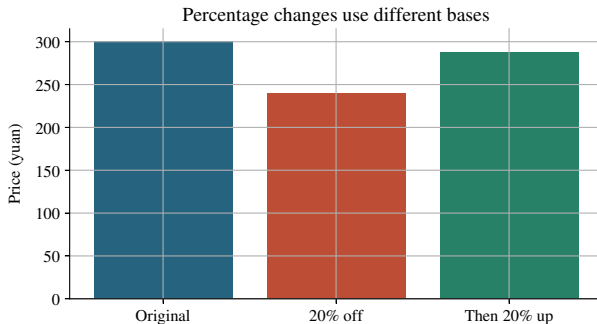
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Percent · 6.2

Reasoning

A factor that performs a percentage change in one multiplication. Choose the relationship, show the method, check its assumptions and interpret the result.

Percent · diagram



- Original teaching diagram: Percentages, ratio and proportional reasoning
- Use the labels and the stated model together.

Percent · original transfer

Your turn

A price rises 20% then falls 20%. Find the net change and the percentage increase needed to recover the original after that pair.

Percent · transfer reasoning

Method and interpretation

Factor $1.2 \times 0.8 = 0.96$, a 4% fall. Recovery factor $1/0.96$, giving 4.1667% increase. Both percentage changes use different bases.

Sequences · 1.1

Reasoning

A saving plan adds ¥30 more each week; a population model grows by 5% each year. Equal differences and equal ratios need different models. This lesson studies common ratio : The constant multiplier between consecutive terms of a geometric sequence.

Sequences · 2.1

Reasoning

For an arithmetic progression, $u_n = a + (n-1)d$ and $S_n = n(2a + (n-1)d)/2$. For a geometric progression, $u_n = ar^{(n-1)}$ and $S_n = a(1-r^n)/(1-r)$. An infinite geometric sum exists only if $|r| < 1$. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Sequences · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$u_n = a + (n - 1)d, \quad S_n = \frac{n}{2} [2a + (n - 1)d]$$

Sequences · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Sequences · 3.3

Reasoning

For $a=5, d=3, n=8$, $u_8=5+7 \times 3=26$ and $S_8=8(10+21)/2=124$. For $a=12, r=1/2$, $S_{\text{infinity}}=12/(1-1/2)=24$. For $u_{(n+1)}=2u_n+1$ with $u_1=1$, the next terms are 3, 7, 15.

Sequences · 4.1

Reasoning

The first term has index 1, so the exponent is $n-1$. A sequence is a list; a series is a sum. A geometric sequence can alternate in sign and still converge. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Sequences · 4.2

Reasoning

Every geometric series has a finite sum to infinity. This claim is false. Explain which definition or assumption it violates.

Sequences · 5.1

Reasoning

Explain whether the context justifies additive or multiplicative change. In finance, distinguish a single deposit from a stream of deposits before choosing a sum formula. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Sequences · 6.1

Reasoning

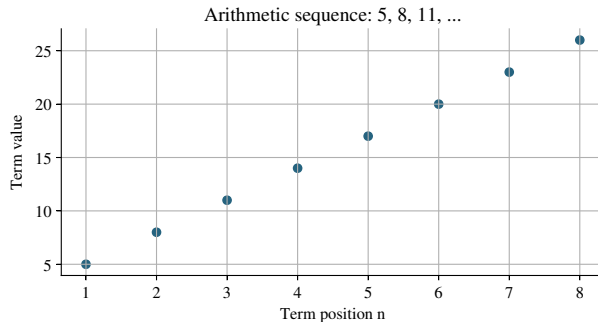
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Sequences · 6.2

Reasoning

The constant multiplier between consecutive terms of a geometric sequence. Choose the relationship, show the method, check its assumptions and interpret the result.

Sequences · diagram



- Original teaching diagram: Sequences, series and recurrence
- Use the labels and the stated model together.

Sequences · original transfer

Your turn

A sequence obeys $u_1=4$ and $u_{n+1}=0.5 u_n+3$. Find its fixed point and express u_n-6 as a geometric sequence. Does the sum of u_n converge?

Sequences · transfer reasoning

Method and interpretation

Fixed point 6. Subtracting 6 gives $u_{n+1}-6=0.5(u_n-6)$, so $u_n=6-2(0.5)^{n-1}$.

Terms approach 6, so their infinite sum diverges; a convergent sequence need not give a convergent series.

Modelling · 1.1

Reasoning

A line predicts bus travel time from distance. A small calculation error matters less than using a model outside its evidence. This lesson studies residual : The observed value minus the value predicted by a fitted model.

Modelling · 2.1

Reasoning

A linear model $y=a+bx$ has intercept a and slope b with contextual units. Inspect residuals and the data range. For repeated percentage change use a geometric model; for a loan distinguish principal, rate, repayment and period. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Modelling · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$\hat{t} = 8 + 2d, \quad e = t - \hat{t}$$

Modelling · 3.2

Reasoning

Check the result against the starting quantities. Substitute into the original relation, or compare the graph and numerical answer where appropriate.

Modelling · 3.3

Reasoning

The fitted model $t=8+2d$ predicts 18 minutes at $d=5$ km. If the observed time is 21, the residual is 3 minutes. A ¥1000 deposit at 5% compound annual interest becomes $1000 \times 1.05^3 = 1157.625$ after 3 years.

Modelling · 4.1

Reasoning

A good fit does not prove a causal mechanism. A correlation coefficient measures linear association, not the gradient. Calculator output must be translated into a model, checked and interpreted. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Modelling · 4.2

Reasoning

A high correlation permits reliable extrapolation to any distance. This claim is false. Explain which definition or assumption it violates.

Modelling · 5.1

Reasoning

In IB AI, record the data source, domain, assumptions and calculator method. Compare an alternative model and judge predictions against residuals. A financial answer must state payment timing and whether interest is compounded. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Modelling · 6.1

Reasoning

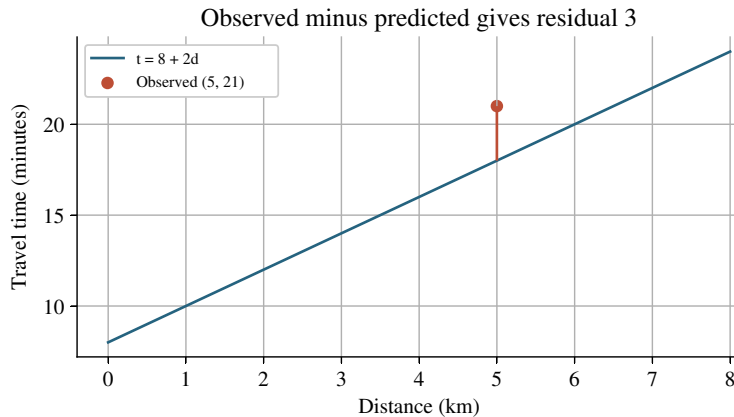
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Modelling · 6.2

Reasoning

The observed value minus the value predicted by a fitted model. Choose the relationship, show the method, check its assumptions and interpret the result.

Modelling · diagram



Residual = observed value minus model prediction.

Modelling · original transfer

Your turn

A fictional journey model is $t=8+2d$. An observed trip at $d=5$ takes 21 minutes. Find the residual, predict at $d=50$ and explain why that prediction needs caution.

Modelling · transfer reasoning

Method and interpretation

Prediction 18, residual+3 minutes; at 50 prediction 108. If the fitted distance range was short, this is extrapolation; traffic, stops and model form may change. Regression does not establish a causal coefficient by itself.

Check yourself

- Explain prime factor using the stated model.
- Explain multiplier using the stated model.
- Change one value in the original transfer; explain which assumption still matters.