

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 Analysis and Approaches 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.

Indices · 1.1

Reasoning

A microscope records a length of 0.000072 metres. A compact representation must keep its size correct. This lesson studies index : The power to which a base is raised.

Indices · 2.1

Reasoning

For the same positive base, multiplication adds indices and division subtracts them. A negative index means reciprocal; a fractional index represents a root. Standard form has $1 \leq a < 10$. State the allowed inputs and units before calculating. An equation should express the relationship, not just record a calculator entry.

Indices · 3.1

Reasoning

Use the displayed relationship within its stated domain.

$$a^m a^n = a^{m+n}, \quad a^{-n} = \frac{1}{a^n}, \quad a^{m/n} = (\sqrt[n]{a})^m$$

Indices · 3.2

Reasoning

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

Indices · 3.3

Reasoning

$0.000072 = 7.2 \times 10^{-5}$. Also $16^{(3/4)} = (16^{(1/4)})^3 = 2^3 = 8$. Simplify $\sqrt{72} = 6\sqrt{2}$, then rationalise $1/\sqrt{2} = \sqrt{2}/2$.

Indices · 4.1

Reasoning

Index laws do not turn a sum into a single power: $2^3+2^4=24$, not 2^7 . Do not round a surd when an exact answer is requested. When a shortcut fails, identify the assumption it breaks. Keep an exact value until the requested final rounding.

Indices · 4.2

Reasoning

For every positive a , $a^2 + a^3$ equals a^5 . This claim is false. Explain which definition or assumption it violates.

Indices · 5.1

Reasoning

Check powers of ten against the original quantity. Use surds for exact geometry, and round only the final length when the question asks for a decimal. A complete solution gives the mathematical result and explains what it means. Check that it is possible in the stated context.

Indices · 6.1

Reasoning

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Indices · 6.2

Reasoning

The power to which a base is raised. Choose the relationship, show the method, check its assumptions and interpret the result.

Indices · diagram

$$0.000072 = 7.2 \times 10^{-5}$$

7.2 is the coefficient; -5 is the power

The coefficient is between 1 and 10

- Original teaching diagram: Indices, surds and standard form
- Use the labels and the stated model together.

Indices · original transfer

Your turn

Solve $x^{3/2}=27$ over the real domain used for this power. Check the result and explain why a negative candidate is invalid.

Indices · transfer reasoning

Method and interpretation

Take the nonnegative real square-root convention: $x \geq 0$. $x = 27^{(2/3)} = 9$; $9^{(3/2)} = 27$.
A negative x has no real square root under this convention.

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

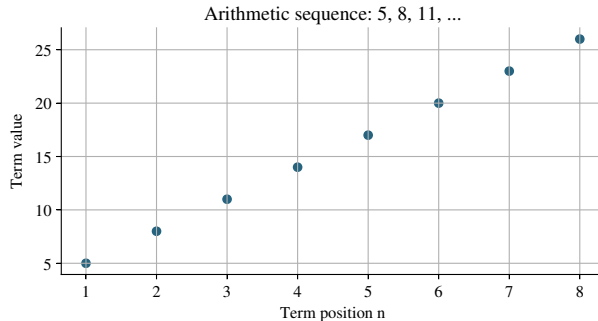
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Sequences · 6.2

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.

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

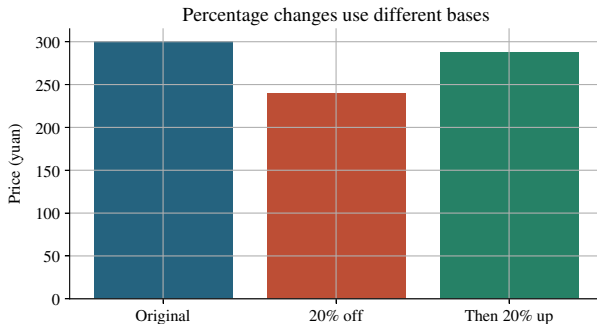
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Percent · 6.2

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.

Check yourself

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