10.11 Modeling Problems

Chapter 10: Final Cumulative Review

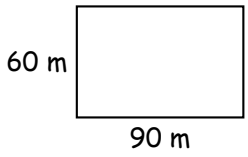
Name: _____ Date: _____ Class/Period: _____

10.401 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

The Spring Carnival

A rectangular carnival site is 90 m by 60 m. Booths occupy 35% of the site and are split between food and games in the ratio $3 : 2$. Food flooring costs $\$6.40$ per square meter. The carnival sells 640 tickets in the ratio child:adult $= 5 : 3$ at $\$2.50$ and $\$4.00$.



(a) Find the booth area and the food-area flooring cost.

(b) Find each ticket count and total ticket revenue.

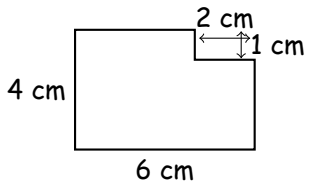
(c) Determine the ticket revenue per square meter of booth area and interpret the result.

10.402 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Library Reading Room

A scale drawing uses 1 cm for 2 m. A reading room is drawn as a 6 cm by 4 cm rectangle with a 2 cm by 1 cm storage corner removed. Carpet costs $\$35.00$ per square meter before a 10% discount.



(a) Find the actual floor area that needs carpet.

(b) Find the discounted carpet cost.

(c) The library has $\$4{,}000$. Determine the amount left for furniture and explain whether the scale drawing was essential.

10.403 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Food-Drive Kits

A food drive collects 144 cans, 96 cereal boxes, and 120 pasta boxes. It makes the greatest possible number of identical kits. After 25% of the kits are donated on Monday, the rest are delivered equally to 6 shelters. One separate delivery trip is made to each shelter, and each trip costs $\$18.75$.

Cans	Cereal	Pasta
144	96	120

(a) Use the GCF to find the number and contents of the kits.

(b) Find how many kits each shelter receives.

(c) Find the total delivery cost and the delivery cost per remaining kit.

10.404 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Bus and Bell Schedule

Buses leave a school every 18 minutes and activity bells ring every 24 minutes. Both occur at 3:00 p.m. A bus carries 48 students. For planning, at most 85% of its seats may be occupied.

(a) Find the next time a bus leaves exactly when a bell rings.

(b) Find the greatest whole number of students allowed on that bus. Explain why the result must be rounded down.

(c) If each student pays $\$2.75$, find the fare revenue at that occupancy.

10.405 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

The Book Fair

A school receives 20 boxes of 24 books. On Monday it sells $\frac{3}{8}$ of all books and on Tuesday it sells 40% of the original number. Each book sells for $\$7.50$.

(a) Find the books sold each day and the number unsold.

(b) Find total revenue and mean revenue per day for the two sale days.

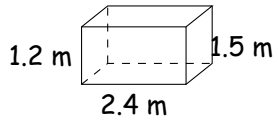
(c) One third of the unsold books are donated and the rest are divided among 6 classrooms. Find each classroom share.

10.406 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Aquarium Refill

An aquarium measures 2.4 m by 1.5 m by 1.2 m and is 35% full. A pump adds 0.18 m^3 per minute while a drain removes 0.06 m^3 per minute.



(a) Find the starting and target volumes if the tank is filled to 80%.

(b) Write and solve an equation for the filling time.

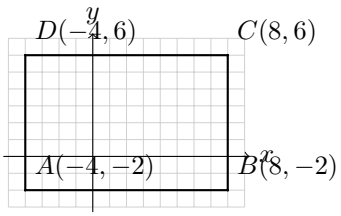
(c) The water utility charges $\$1.25$ per cubic meter of pump output, including water that leaves through the drain. Find the water cost, rounded to the nearest cent.

10.407 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Coordinate Playground

A rectangular playground has vertices $(-4, -2)$, $(8, -2)$, $(8, 6)$, and $(-4, 6)$ on a map where one unit represents 3 meters. A safety surface covers 62.5% of the playground and costs $\$28$ per square meter.



(a) Find the actual dimensions and area.

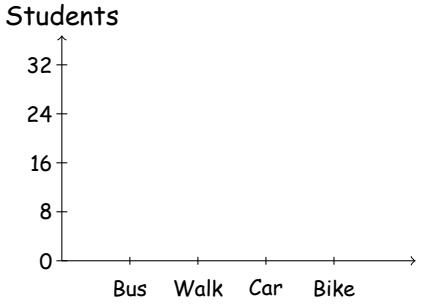
(b) Find the safety-surface area and cost.

(c) If the budget is $\$55{,}000$, determine the surplus or shortfall.

10.408 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Transportation Survey

A random sample of 80 students reports transportation in the ratio bus:walk:car:bike $= 3 : 2 : 4 : 1$. The mean commute time is 18.5 minutes with MAD 4.2 minutes.



(a) Find each category count and percent.

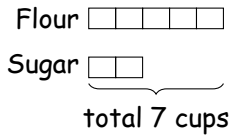
(b) Draw a bar graph of the counts.

(c) Interpret the mean and MAD, then explain one reason the sample could still be biased.

10.409 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Bakery Order

A recipe uses flour:sugar $= 5 : 2$ and makes 24 muffins from 7 cups of ingredients. A bakery needs 180 muffins. Flour is sold in 5-cup bags for $\$4.80$ and sugar in 2-cup bags for $\$3.20$.



(a) Scale the recipe to find the flour and sugar needed.

(b) Find the number of whole bags and total ingredient cost.

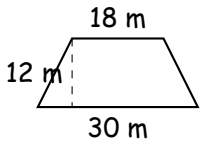
(c) If each muffin sells for $\$1.25$, find profit before other expenses and the percent of revenue spent on ingredients.

10.410 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Solar Roof

A trapezoidal roof has bases 18 m and 30 m and height 12 m. Panels cover 60% of the roof. Each panel covers 1.8 m^2 and costs $\$245$. Daily outputs for five days are $42, 45, 39, 48,$ and 46 kWh.



(a) Find the roof and panel-covered areas and the number of whole panels needed.

(b) Find the panel cost.

(c) Find the mean and range of the outputs and state one limitation of using five days to predict a year.

10.411 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

School Mural

A wall is 12 m by 5 m. A mural covers $\frac{3}{4}$ of the wall, and 40% of the mural is blue. One liter covers 8 m^2. Blue paint costs $\$21.60$ per liter and other paint costs $\$18.40$ per liter.

(a) Find the blue and nonblue mural areas.

(b) Find the whole liters of each paint needed and total cost.

(c) Find the percent of the wall that is blue and explain why paint must be rounded up.

10.412 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Field-Trip Tickets

A museum charges $\$14$ per student plus a fixed $\$180$ group fee. The school has 126 students and buses hold 48. A grant pays 35% of the admission cost.

(a) Find the number of buses needed.

(b) Find total admission cost and the amount paid by the grant.

(c) Find the remaining cost per student, rounded to the nearest cent.

10.413 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Garden Irrigation

Three sprinklers repeat every 12, 18, and 30 minutes and begin together. Each time all three run together, they use 240 liters. A leak wastes 8% of that water.

(a) Find how often all three begin together.

(b) Find how many joint starts occur from 6:00 a.m. through noon, including both endpoints.

(c) Find the useful water and wasted water during those joint starts.

10.414 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Tournament Day

Eight teams play a single-elimination tournament. Each game lasts 42 minutes with a 12-minute break after every game except the final. Adult and student tickets are sold in the ratio $2:5$; 490 tickets are sold at $\$8$ and $\$5$.

(a) Find the number of games and total event time.

(b) Find adult and student ticket counts and revenue.

(c) Find revenue per game and explain whether it measures attendance.

10.415 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Recycling Goal

Weekly recycling masses are $82, 95, 91, 104,$ and 108 kg. The school wants the next week to raise the six-week mean to 100 kg. It earns $\$0.18$ per kilogram and donates 25% of the earnings.

Week	1	2	3	4	5
kg	82	95	91	104	108

(a) Find the required sixth-week mass.

(b) Find the six-week range and mean.

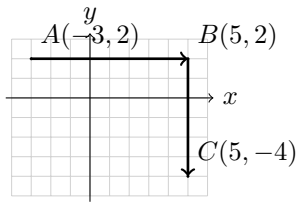
(c) Find total earnings and the amount donated.

10.416 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Delivery Route

A driver travels from $A(-3, 2)$ to $B(5, 2)$ and then to $C(5, -4)$. One grid unit represents 4 km. The trip takes 0.7 hour and the van uses one gallon per 12 km. Fuel costs $\$3.60$ per gallon.



(a) Find the total distance and average speed.

(b) Find fuel used and cost.

(c) A direct diagonal route would be 40 km. Find the percent by which the grid route is longer.

10.417 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Classroom Supply Cycle

A teacher has 72 pencils and 48 erasers and makes the greatest number of identical sets. Pencils are restocked every 15 days and erasers every 20 days. A pencil pack costs $\$6.75$ after a 10% discount.

(a) Find the number and contents of the sets.

(b) Find the next day both supplies are restocked together.

(c) Find the original pencil-pack price before the discount.

10.418 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Theater Seating

A theater has 16 rows of 28 seats. Twelve and one-half percent are reserved for staff. Of the remaining seats, adult and student tickets are sold in the ratio $3:5$ at $\$12$ and $\$8$.

(a) Find the staff and sellable seats.

(b) Find each ticket count and total revenue if all sellable seats are sold.

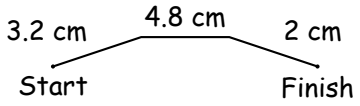
(c) Find the mean revenue per sellable seat.

10.419 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Trail Map

A trail map uses 1 cm for 2.5 km. A route has map lengths 3.2 cm, 4.8 cm, and 2 cm. A hiker walks the first 60% at 5 km/h and the rest at 4 km/h.



(a) Find the actual route length.

(b) Find the time for each portion and total time.

(c) Find the average speed for the entire route.

10.420 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Restaurant Batch

A soup uses broth:vegetables $= 7:3$. A kitchen makes 50 liters, loses 8% during cooking, and sells the remainder in 0.4-liter bowls for $\$6.50$ each. Ingredients cost $\$2.10$ per original liter.

(a) Find the original amounts of broth and vegetables.

(b) Find the number of complete bowls sold and any soup left.

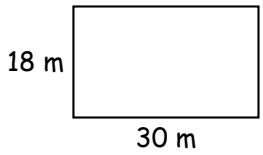
(c) Find ingredient cost, revenue, and gross profit.

10.421 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Museum Exhibit Model

A rectangular exhibit is 30 m by 18 m. A model uses scale $1 : 150$. A redesign multiplies every real length by 1.125, which represents a 12.5% increase. Flooring costs $\$24.50$ per square meter.



(a) Find the model dimensions in centimeters.

(b) Find the original area. Then use the area multiplier $(1.125)^2$ to find the redesigned area and the percent increase in area.

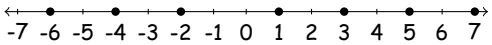
(c) Find the cost of flooring only the added area.

10.422 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Cold-Weather Week

Noon temperatures from Monday through Sunday are, in order, $-6, -2, 3, 5, 1, -4,$ and $7°C$. A heating system uses 4.5 kWh for each degree the temperature is below $5°C$. Electricity costs $\$0.16$ per kWh.



(a) Find the mean, median, and range of the temperatures.

(b) Find total heating energy for the week.

(c) Find the energy cost and identify the weekday whose temperature is farthest from the mean.

10.423 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Two Fundraising Plans

Plan A earns $180 + 4.25n$ dollars and Plan B earns $90 + 5.75n$ dollars for n items sold. Twelve percent of either plan is used for expenses.

(a) Find and check the break-even value of n.

(b) Compare net earnings for 40 and 100 items.

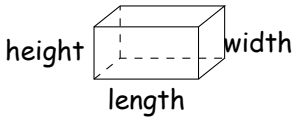
(c) Explain algebraically why the common percent expense does not change the break-even point.

10.424 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Crate Design

A shipping crate must have whole-number dimensions and volume 240 cubic feet. Material costs $\$7.50$ per square foot of surface area, and packing may use only 80% of the volume.



(a) Test factor triples to find dimensions with least surface area.

(b) Find the usable packing volume.

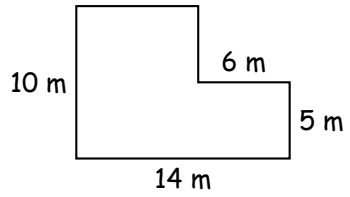
(c) Find the material cost and explain why the least-surface-area design is preferred.

10.425 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Art-Fair Booth

An L-shaped booth is formed from a 14 m by 10 m rectangle with a 6 m by 5 m corner removed. Displays cover 45% of the floor. Visitor counts for four hours are $36, 48, 52,$ and 44.



(a) Find the booth and display areas.

(b) Find the mean and MAD of the hourly counts.

(c) If flooring costs $\$18$ per square meter, find the uncovered-floor cost and recommend whether one mean hour is a reasonable staffing basis.

10.426 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Water-Treatment Mixture

A 900-liter tank contains chemical solution and water in the ratio $1:8$. After 60 liters of chemical are added, a pump removes mixture at 45 L/min for 6 minutes.

(a) Find the original chemical and water amounts.

(b) Find the new chemical percent before pumping.

(c) Assuming the mixture stays uniform, find the chemical amount remaining after pumping.

10.427 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Hiking Elevation

A hiker begins at elevation -120 m, climbs 340 m, descends 85 m, then climbs 40% of the first climb. The horizontal distance is 7.5 km and the trip takes 2.4 hours.

(a) Find the final elevation and total vertical movement.

(b) Find average horizontal speed.

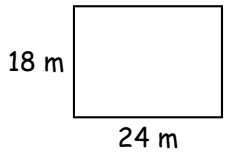
(c) Find the final elevation as a percent of the 340 m distance climbed during the first climb. Round to the nearest tenth of a percent.

10.428 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Vegetable Garden

A 24 m by 18 m garden is divided into the greatest possible identical square plots. Paths occupy $\frac{1}{6}$ of the total area. The remaining growing area is divided between vegetables and flowers in the ratio $5:1$.



(a) Find the side length and number of square plots.

(b) Find vegetable and flower areas.

(c) If vegetable soil costs $\$9.25$ per square meter, find its cost.

10.429 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Lab Concentration

A solution has acid:water $= 2 : 7$. After 15 liters of water are added, the ratio becomes $1 : 5$. The solution is then poured equally into 6 containers.

(a) Write and solve an equation for the original amounts.

(b) Find the new total volume and acid percent.

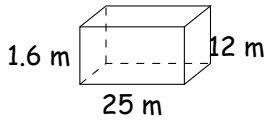
(c) Find the volume in each container.

10.430 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Community Pool

A pool measures 25 m by 12 m by 1.6 m and is 72% full. It loses 8 m^3 per hour while a hose adds 3 m^3 per hour. Water costs $\$1.40$ per cubic meter.



(a) Find the starting volume.

(b) Find the time to reach 60% full.

(c) Find the net water lost and its replacement cost.

10.431 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Concert Ticket Model

A concert sells 620 tickets. Adult tickets cost $\$18$ and student tickets cost $\$12$, and total revenue is $\$9{,}240$. Online buyers, who are 35% of all buyers, pay an additional $\$1.50$ fee.

(a) Find adult and student ticket counts.

(b) Find online-fee revenue.

(c) Find total revenue including fees and mean revenue per ticket.

10.432 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Bike-Rental Choice

Shop A charges $\$12 + 4.50h$ and Shop B charges $\$6 + 5.25h$ for h hours. An 8% tax is added. A group records rental times $2, 3, 3, 4,$ and 6 hours.

(a) Find the break-even time before tax.

(b) Use the median rental time to choose the cheaper shop after tax.

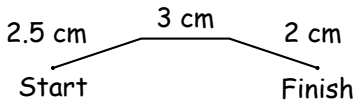
(c) Find the range and mean of the rental times and explain whether the mean changes the recommendation.

10.433 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Shipping Route

A map uses 1 cm for 18 km. A route measures 7.5 cm and includes a 12% detour. A truck travels at 72 km/h and uses 1 liter of fuel per 9 km. Fuel costs $\$1.62$ per liter.



(a) Find the route length before and after the detour.

(b) Find travel time and fuel used after the detour.

(c) Find fuel cost of the trip.

10.434 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Orchard Rows

An orchard is 84 m by 60 m. Trees are planted at the corners of the largest possible equal square grid. Eighty percent of the planting positions produce fruit. Fruit masses from five sampled trees are $38, 42, 44, 41,$ and 45 kg.

(a) Find the grid spacing and total planting positions.

(b) Find the expected number of producing trees.

(c) Find the sample mean and range, then estimate total fruit mass using the mean.

10.435 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Package and Ship

A warehouse has 96 mugs, 144 plates, and 120 bowls. It makes the greatest number of identical sets. Each set occupies $2{,}400$ cm^3, and a box may be filled to 75% of its $19{,}200$ cm^3 capacity.

Mugs	Plates	Bowls
96	144	120

(a) Find the number and contents of the sets.

(b) Find how many sets fit in one box and the number of boxes needed.

(c) If each box costs $\$2.85$, find total packaging cost.

10.436 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Data-Plan Comparison

Plan A costs $25 + 3.5g$ dollars and Plan B costs $46 + 2g$ dollars for g gigabytes. Both add a 6% fee. Monthly usage is $6, 8, 9, 11,$ and 16 GB.

(a) Find the break-even usage.

(b) Find the mean and median usage.

(c) Use both center measures to compare the plans and explain whether the fee changes the break-even point.

10.437 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Animal Shelter

A shelter has cats:dogs:rabbits $= 4 : 3 : 1$ and 96 animals total. During a month, 62.5% of the cats, $\frac{2}{3}$ of the dogs, and 50% of the rabbits are adopted. Remaining animals consume 1.2 kg of food per day.

(a) Find the original and remaining counts.

(b) Find the overall adoption percent.

(c) Find one week of food needed and its cost at $\$2.40$ per kilogram.

10.438 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

School Election Poll

A school has grade populations in ratio $2 : 3 : 5$. A proportional sample of 80 students gives Candidate A 44 votes. Ten sampled students did not respond.

(a) Find the intended sample count from each grade.

(b) Find Candidate Aś percent among respondents.

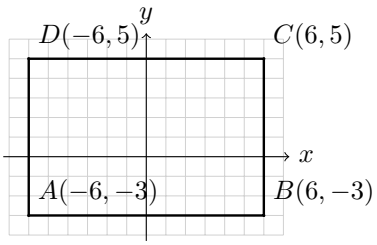
(c) Explain how nonresponse could bias the estimate and give a reasonable interval for Aś support if all nonrespondents chose the same candidate.

10.439 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Snow-Clearing Map

A rectangular parking lot has vertices $(-6,-3)$, $(6,-3)$, $(6,5)$, and $(-6,5)$, where one unit is 5 m. Snow covers 65% of the lot. A plow clears 900 m^2 per hour and costs $\$72$ per hour.



(a) Find the actual lot and snow-covered areas.

(b) Find clearing time and cost.

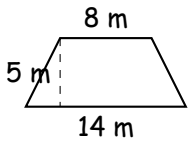
(c) If the company bills whole quarter-hours, determine the billed cost.

10.440 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Greenhouse Roof

A greenhouse roof consists of two congruent trapezoids with bases 8 m and 14 m and height 5 m. Glass covers 92% of the roof; the rest is framing. Glass costs $\$68$ per square meter. Daily temperatures are $18, 21, 23, 20,$ and $28°C$.



(a) Find total roof, glass, and framing areas.

(b) Find glass cost.

(c) Find the mean, median, and range of the temperatures and identify a possible outlier.

10.441 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Dance-Recital Schedule

Rehearsals for three groups repeat every 20, 30, and 45 minutes and start together at 1:00 p.m. The auditorium has 360 seats, 15% reserved. Remaining tickets are sold adult:student $= 2 : 7$ at $\$10$ and $\$6$.

(a) Find the next joint rehearsal time.

(b) Find ticket counts and revenue if all available seats sell.

(c) Find revenue per occupied seat, including reserved seats as occupied but free.

10.442 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Reading Challenge

Five classes read $84, 96, 105, 90,$ and 125 books. The school donates 40% of the total and shelves the rest equally on 10 shelves. Each shelf holds at most 32 books.

(a) Find the mean and range of class totals.

(b) Find donated and remaining books.

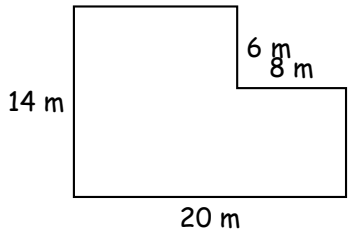
(c) Determine whether 10 shelves are enough and the minimum number required.

10.443 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Playground Fence

An L-shaped playground is formed from a 20 m by 14 m rectangle with an 8 m by 6 m corner removed. A contractor charges $\$42$ per meter of outer fence plus a fixed $\$350$ fee, then gives a 5% discount.



(a) Find the outer perimeter.

(b) Write an expression for the discounted cost and evaluate it.

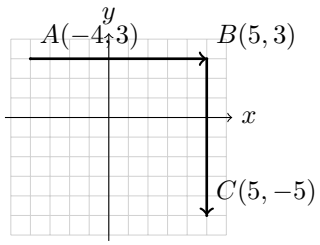
(c) If the budget is $\$2{,}800$, find the surplus or shortfall.

10.444 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Drone Delivery

A drone flies from $A(-4, 3)$ to $B(5, 3)$ and then to $C(5, -5)$, with one unit equal to 0.8 km. It flies at 24 km/h. The first leg uses 18% of its battery and the second uses battery in proportion to distance.



(a) Find each distance and total flight time.

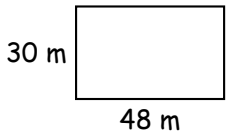
(b) Find the percent of battery used on the second leg and total used.

10.445 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Farmers-Market Stalls

A 48 m by 30 m market reserves 25% of its area for walkways. The remaining area is divided among produce, crafts, and food in ratio $5 : 3 : 2$. Rent is $\$14$ per square meter, but food stalls pay 20% more.



(a) Find each stall-category area.

(b) Find total rent collected.

(c) Find the percent of total rent contributed by food stalls.

10.446 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Emergency Supply Rotation

A center has 180 water packs, 144 food packs, and 108 blanket packs and makes identical emergency units. Water expires every 24 months, food every 18 months, and blankets are inspected every 30 months.

(a) Find the greatest number and contents of the units.

(b) Find when all three replacement cycles next coincide.

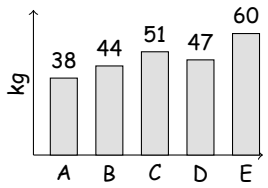
(c) If 25% of the units are used before that date, find the units remaining.

10.447 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

River Cleanup

Five cleanup teams collect $38, 44, 51, 47,$ and 60 kg of trash. Metal is 30% of the total and earns $\$0.42$ per kilogram; the rest costs $\$0.18$ per kilogram to dispose of.



(a) Find the mean, median, and range of team totals.

(b) Find metal and nonmetal masses.

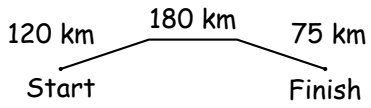
(c) Find net recycling income after disposal cost and decide whether the 60 kg result is an outlier worth investigating.

10.448 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Mountain Road Trip

A car travels 120 km at 60 km/h, 180 km at 90 km/h, and 75 km at 50 km/h. A detour increases the final leg by 20%. The car uses 7.5 L per 100 km and fuel costs $\$1.68$ per liter.



(a) Find total distance and travel time.

(b) Find average speed for the trip.

(c) Find fuel used and fuel cost.

10.449 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

School Lunches

A cafeteria prepares lunches in vegetarian:regular ratio $3 : 7$ for 500 students. Eight percent of all lunches are unused. Vegetarian lunches cost $\$3.80$ and regular lunches $\$4.25$.

(a) Find each lunch count and unused total.

(b) Assuming the same unused percent in each category, find served counts.

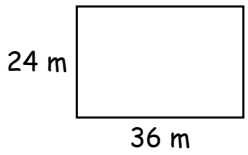
(c) Find preparation cost and cost per served lunch.

10.450 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Community-Center Funding

A model of a 36 m by 24 m room uses scale $1 : 300$. Renovation increases each length by 25%. Flooring costs $\$18.75$ per square meter. A donor plan gives $\$25{,}000 + 12d$ dollars for d donors.



(a) Find model dimensions and original and renovated areas.

(b) Find renovation flooring cost.

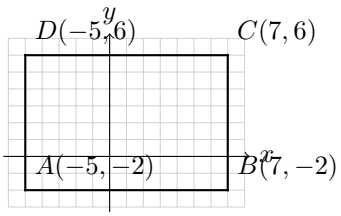
(c) Write and solve an inequality for the least donors needed.

10.451 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Parking-Lot Revenue

A parking lot has vertices $(-5,-2)$, $(7,-2)$, $(7,6)$, and $(-5,6)$, with one unit equal to 4 m. Forty percent of the area is used for spaces, and each space needs 24 m^2. Eighty percent of spaces are occupied at $\$6$ each.



(a) Find total area and the greatest whole number of spaces.

(b) Find expected occupied spaces and revenue.

(c) Explain every rounding decision.

10.452 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Painting a Classroom

A classroom is 9 m by 7 m by 3 m high. Doors and windows cover 18 m^2. Paint covers 10 m^2 per liter and costs $\$32$ per 4-liter can before a 15% discount.

(a) Find the wall area to paint.

(b) Find liters and whole cans needed.

(c) Find discounted cost and unused paint.

10.453 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Toy-Factory Shift

A machine produces toys continuously at a constant rate of 4 toys per minute for a 7.5-hour shift. Six percent are defective. Good toys are packed in equal cases of 24 and sold to stores for $\$8.40$ each.

(a) Find total and good toys.

(b) Find full cases and leftovers.

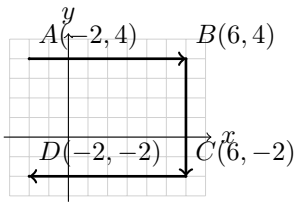
(c) Find revenue from all good toys and the defective-loss value at the selling price.

10.454 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Newspaper Route

A carrier travels from $(-2, 4)$ to $(6, 4)$ to $(6, -2)$ and back to $(-2, -2)$. One unit is 0.5 km. The route takes 45 minutes, and the carrier earns $\$0.22$ for each of 180 papers delivered.



(a) Find route distance and average speed.

(b) Find total earnings and earnings per kilometer.

(c) If 10% of papers are returned, find adjusted earnings.

10.455 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Camp Cabins

A camp has 168 campers and 24 counselors. It makes the greatest number of identical cabin groups. Each cabin has 48 m^2 of floor area and is allowed to be at most 85% occupied by beds, each using 3 m^2.

(a) Find the number of cabin groups and people in each.

(b) Find the greatest number of beds allowed in one cabin.

(c) Determine whether one cabin per group is sufficient.

10.456 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Library Growth Data

Annual checkouts are $42{,}000, 45{,}500, 47{,}000, 49{,}500,$ and $56{,}000$. Next year is projected to be 12% above the five-year mean. Shelves hold books in fiction:nonfiction ratio $7:3$, with $18{,}000$ books total.

(a) Find mean, median, and range of checkouts.

(b) Find the projected next-year checkouts.

(c) Find fiction and nonfiction counts and compare the projected checkouts with total books as a percent.

10.457 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Bottled-Water Sale

A club buys 18 cases of 24 bottles for $\$13.50$ per case. It sells 75% at $\$1.25$ each and the remainder at a 20% discount.

(a) Find total cost and each selling-price quantity.

(b) Find total revenue and profit.

(c) Find the profit as a percent of cost (the markup rate) and as a percent of revenue (the profit margin). Round each to the nearest tenth of a percent and explain why the rates use different denominators.

10.458 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Chess Tournament

Twelve players each play every other player once. Games average 18 minutes, and four games can run at once. Entry fees are adult:student $= 1 : 5$ for 72 spectators at $\$7$ and $\$4$.

(a) Find the number of chess games.

(b) Estimate tournament time if rounds are filled as evenly as possible.

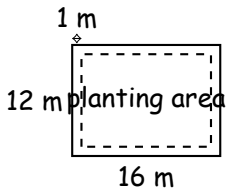
(c) Find spectator counts and fee revenue.

10.459 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Garden Path Budget

A 16 m by 12 m garden has a uniform path 1 m wide inside its border. Gravel covers 6 m^2 per bag and costs $\$8.75$ per bag. A coupon discounts the bag cost by 12%.



(a) Find the path area.

(b) Find whole bags needed.

(c) Find discounted cost and percent of the garden used by the path.

10.460 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

School-Dance Break-Even

The dance costs $\$1{,}350$ to run. Tickets are sold student:guest $= 4 : 1$ at $\$8$ and $\$12$. A payment service keeps 5% of revenue.

(a) Write an expression for net revenue when $5k$ tickets are sold.

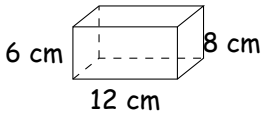
(b) Find the least whole value of k that breaks even.

(c) Find each ticket count and the profit or loss at that attendance.

10.461 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Aquarium Exhibit

A scale model of a tank is 12 cm by 8 cm by 6 cm at scale $1 : 25$. The real tank is filled to 68%. Five visitor groups contain $24, 31, 29, 35,$ and 41 people.



(a) Find the real dimensions. Explain why the real volume is the model volume multiplied by 25^3, then find the real volume in liters.

(b) Find the water volume when the real tank is 68% full.

(c) Find the mean and range of the group sizes and estimate how many complete mean-sized groups could visit before the total would exceed 500 visitors.

10.462 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Coding-Club Patterns

A four-light code uses on/off settings with no two adjacent lights on. The club tests every legal code 18 times. Twelve and one-half percent of tests fail, and each successful test earns $\$0.40$ in sponsorship.

Light 1	Light 2	Light 3	Light 4

(a) List and count all legal codes.

(b) Find total tests and successful tests.

(c) Find sponsorship earnings.

10.463 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Recycling-Bin Shipment

A center has 72 paper bins, 108 plastic bins, and 90 metal bins and makes identical shipments. Each bin occupies 0.08 m^3. Trucks may use only 80% of their 9 m^3 cargo volume and cost $\$46$ per trip.

(a) Find the greatest number and contents of shipments.

(b) Find total bin volume and the greatest bins per truck.

(c) Find trips and total truck cost.

10.464 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Track Improvement

A runner records 400-meter times of $78, 76, 75, 74,$ and 72 seconds. The goal is a sixth time that lowers the six-run mean to 74 seconds. Entry fees rise from $\$24$ to $\$27$.

(a) Find the required sixth time.

(b) Find the original and new ranges.

(c) Find the percent increase in the entry fee and compare it with the percent decrease from the first to required sixth time.

10.465 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

School Newspaper

A printer makes 86 pages per minute for 7.5 hours. Four percent are discarded. Newspapers use 18 pages each and sell for $\$1.25$. Printing costs $\$0.035$ per page produced.

(a) Find pages produced and usable.

(b) Find complete newspapers and leftover pages.

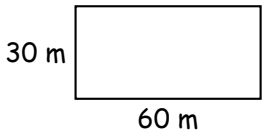
(c) Find revenue, printing cost, and gross profit.

10.466 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Ice-Rink Event

A rink is 60 m by 30 m. A center logo covers 12% of the area. Spectator seats are arranged in 18 rows of 24, with 12.5% reserved. Remaining tickets sell adult:student $= 2 : 7$ at $\$9$ and $\$6$.



(a) Find logo and skating areas.

(b) Find sellable seats and each ticket count.

(c) Find revenue and revenue per square meter of skating area.

10.467 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Feed Mixture

A farm mixes grain:protein:mineral $= 7:2:1$ for a 450-kg batch. Eight percent is lost during storage. The remaining feed is divided equally among 18 pens and costs $\$0.64$ per original kilogram.

(a) Find each ingredient mass.

(b) Find feed remaining and feed per pen.

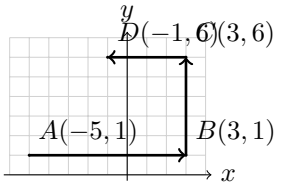
(c) Find total cost and cost per kilogram actually used.

10.468 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Park Paths

On a coordinate map, a walker goes from $A(-5,1)$ to $B(3,1)$ to $C(3,6)$ to $D(-1,6)$. One unit is 120 m. The walker moves at 4.8 km/h and rests for 12 minutes.



(a) Find total walking distance.

(b) Find walking and total elapsed time.

(c) Find average speed including the rest.

10.469 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Museum Spending Survey

A random sample of 50 visitors has mean spending $\$18.40$ and MAD $\$4.10$. Children:adults in the sample are $2:3$. The museum had $1{,}250$ visitors that day, but the sample was collected only in the gift shop.

(a) Find child and adult sample counts.

(b) Use the mean to estimate total visitor spending.

(c) Explain why the estimate may be biased and give a better sampling plan.

10.470 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Jacket Sale Comparison

Two stores sell a $\$160$ jacket. Store A gives 35% off. Store B subtracts $\$40$ and then gives 10% off. Both add 8% tax. Customer purchase totals over five visits are $120, 138, 145, 151,$ and 196 dollars.

(a) Find each final jacket price.

(b) Find mean and median purchase totals.

(c) Choose the better jacket store and explain which center better represents a typical visit.

10.471 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Donation-Box Packing

A charity has 120 soap bars, 168 toothbrushes, and 216 washcloths and makes identical kits. Each kit occupies $1{,}800$ cm^3. Boxes have capacity $18{,}000$ cm^3 but may be only 80% full.

(a) Find the greatest number and contents of kits.

(b) Find kits per box and boxes needed.

(c) If box costs are $\$2.40$ each after a 20% discount, find original and discounted total costs.

10.472 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Music-Lesson Calendar

Piano lessons repeat every 6 days, guitar every 8 days, and drums every 15 days. All meet on September 1. Each of the three groups has 12 scheduled students. At a joint meeting, 75% of each group attends, and each attendee pays $\$14$.

(a) Find the next date all three meet together.

(b) Find expected attendance and revenue at a joint meeting.

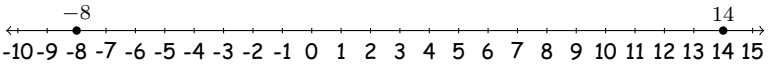
(c) Find revenue per scheduled student and explain the percent relationship.

10.473 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Temperature Experiment

A sample changes temperature from $-8°C$ to $14°C$ in four equal time intervals. The recorded temperatures form an arithmetic sequence. The heater uses 0.6 kWh per degree of total increase at $\$0.17$ per kWh.



(a) Find all five temperatures.

(b) Find their mean and range.

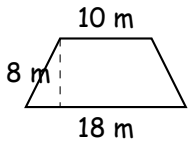
(c) Find heater energy and cost.

10.474 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Campus Roof Plan

A roof is a 24 m by 18 m rectangle joined to a trapezoid with bases 10 m and 18 m and height 8 m. Panels cover 55% of the total area. Monthly outputs are $3{,}800, 4{,}100, 4{,}250,$ and $4{,}650$ kWh.



(a) Find total roof and panel areas.

(b) Find mean and range of outputs.

(c) If installation costs $\$210$ per square meter of panel area, find cost per mean monthly kWh.

10.475 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Snack-Mix Stand

A mix uses nuts:pretzels:fruit $= 3 : 5 : 2$. A stand makes 80 kg, loses 5% to spills, and sells 0.25-kg bags. Cost is $\$4.20$ per original kilogram; bags sell for $\$2.25$, with 25% sold at a 10% discount.

(a) Find each ingredient mass and saleable mass.

(b) Find full bags and each price-category count.

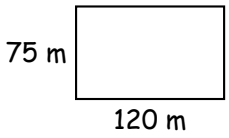
(c) Find revenue, cost, and profit percent based on cost.

10.476 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Field Irrigation

A rectangular field is 120 m by 75 m. It receives water to a depth of 0.012 m, but 18% is lost. A pump delivers 45 m^3 per hour and costs $\$32$ per hour to run.



(a) Find water volume applied and useful volume.

(b) Find pumping time and operating cost.

(c) Find the cost per useful cubic meter.

10.477 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Mosaic Tiles

A floor is 84 cm by 126 cm and is covered by the largest possible identical square tiles. One third of the tiles are blue and the rest are white. Blue tiles cost $\$1.40$ and white tiles $\$0.95$.

(a) Find tile side length and number of tiles.

(b) Find each color count.

(c) Find total cost.

10.478 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Bus-Contract Choice

Company A charges $420 + 2.40m$ dollars and Company B charges $300 + 3.20m$ dollars for m miles. A fuel surcharge of 7% applies to both. Trip distances are $110, 135, 150, 160,$ and 195 miles.

(a) Find the break-even distance.

(b) Find mean and median trip distances.

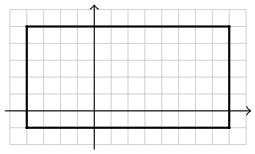
(c) Use both centers to recommend a company and explain why the surcharge does not change the break-even point.

10.479 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Habitat Enclosure

A rectangular enclosure has coordinate vertices $(-4,-1)$, $(8,-1)$, $(8,5)$, and $(-4,5)$, with one unit equal to 2 m. Water occupies $\frac{1}{4}$ of the area and shelter occupies 15%; the rest is grass costing $\$18$ per square meter.



(a) Find actual dimensions and area.

(b) Find water, shelter, and grass areas.

(c) Find grass cost.

10.480 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Fitness Study

Five students run 1.5 km in $8.0, 8.4, 8.7, 9.1,$ and 10.8 minutes. After training, each time decreases by 6%.

Student	A	B	C	D	E
min	8.0	8.4	8.7	9.1	10.8

(a) Find the original mean, median, and range.

(b) Find each new time and the new mean.

(c) Explain how multiplying every value by 0.94 changes the mean and range.

10.481 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Shipping-Crate Optimization

A closed rectangular crate must have whole-number dimensions and volume 360 cubic units. It may be filled to 85%, and material costs $\$3.20$ per square unit of surface area.

(a) Test factor triples and find a crate with least surface area.

(b) Find usable volume and material cost.

(c) Compare it with a $5 \times 8 \times 9$ crate and justify the better design.

10.482 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Theater-Rectangle Study

A rectangular seating region has perimeter 80 m. One square meter holds 2 seats, 12.5% of seats are reserved, and sold tickets average $\$9.40$.

Width	Length	Area	Revenue
12			
16			
18			
20			

(a) Compare the areas for widths $12, 16, 18,$ and 20 m.

(b) For each design, estimate sellable seats and revenue.

(c) Recommend a width and explain the area symmetry around the square design.

10.483 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Tank-Surface Optimization

An open-top rectangular tank has whole-number base dimensions, height 4 units, and volume 288 cubic units. Material costs $\$5$ per square unit, and the tank operates at 75% capacity.

(a) Find possible base factor pairs.

(b) Find the design using the least material.

(c) Find material cost and operating volume.

10.484 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Garden-Fence Optimization

A rectangular garden uses 72 m of fencing. A path occupying 10% of the garden is added inside. Soil costs $\$6.50$ per square meter of planting area.

(a) Compare widths $12, 16, 18,$ and 20 m.

(b) Find planting area and soil cost for each.

(c) Recommend a design that maximizes planting area and explain the pattern.

10.485 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Fundraiser Target

Plan A earns $200 + 4n$ dollars and Plan B earns $80 + 5.50n$ dollars. Ten percent of either total pays expenses. The goal is at least $\$720$ net.

(a) Find the break-even sales count.

(b) Find the least sales count meeting the goal under each plan.

(c) Recommend a plan for expected sales of 90 items and justify the decision.

10.486 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Sampling Investigation

A school has grades in ratio $3 : 4 : 5$ and wants a sample of 120 students. A pilot sample from the cafeteria reports mean homework time 46 minutes and MAD 18 minutes.

(a) Design a proportional grade sample.

(b) Explain why the cafeteria pilot may be biased.

(c) Propose a better procedure and explain how mean and MAD would be used to compare pilot and final samples.

10.487 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Recipe-Package Optimization

A recipe uses flour:sugar $= 5 : 3$ and makes 16 servings from 8 cups. A caterer needs at least 150 servings. Flour comes in 10-cup bags for $\$7.20$ and sugar in 6-cup bags for $\$5.40$.

(a) Find ingredient amounts needed.

(b) Find bag counts, total cost, and unused amounts.

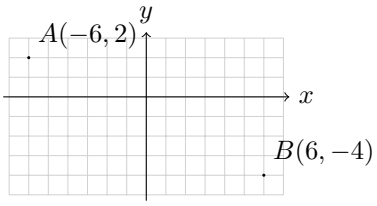
(c) Compare with making 160 servings and decide which choice has the lower waste percent.

10.488 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Route Optimization

Two routes connect $A(-6,2)$ and $B(6,-4)$. Route 1 uses one horizontal and one vertical segment. Route 2 follows three segments of 5, 8, and 9 km. One coordinate unit is 1 km. A vehicle travels 48 km/h and uses one liter per 12 km.



(a) Find both route distances.

(b) Find time and fuel for each.

(c) Choose a route if fuel costs $\$1.70$ per liter and time is valued at $\$18$ per hour.

10.489 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Warehouse-Packing Optimization

A warehouse packs 144 jars, 96 boxes, and 120 bags into identical kits. Kits are placed in boxes holding at most 8 kits or $15{,}000$ cm^3, whichever is more restrictive. Each kit occupies $2{,}100$ cm^3.

(a) Find the greatest number and contents of kits.

(b) Find the effective kit limit per box and boxes needed.

(c) If boxes cost $\$2.75$ each with a 12% discount, find total cost.

10.490 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Designing a Data Set

A coach wants to create a set of seven integer scores. The data set must have a mean of 12, a median of 10, a unique mode of 8, and a range of 20. Any score below 10 is considered incomplete.

(a) Create a data set that meets all four conditions. If no such data set exists, explain why.

(b) What percent of the scores in your data set are incomplete?

(c) Using your data set from part (a), replace exactly one score so that the mean increases from 12 to 14. The median, mode, and range must remain unchanged. Explain how you know your new data set meets all the conditions.

10.491 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Cafeteria Scheduling

Three lunch lines serve one student every 18, 24, and 30 seconds. They start together with 240 students waiting. Sixty percent choose Line A, 25% Line B, and the rest Line C.

(a) Find how often all lines complete a service simultaneously.

(b) Find students assigned to each line.

(c) Estimate each lineś finishing time and identify the bottleneck.

10.492 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Solar-Battery Investigation

Five daily solar outputs are $36, 42, 45, 39,$ and 48 kWh. A battery stores 80% of generated energy and loses 5% of stored energy overnight. The school uses 32 kWh per day.

(a) Find mean and range of daily output.

(b) For a mean-output day, find usable stored energy after overnight loss.

(c) Determine whether that energy meets one day of use and find the surplus or shortfall percent.

10.493 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Open-Box Investigation

Whole-number squares of side x are cut from the corners of a 12-by-12 sheet to make an open box. Possible values are $x = 1, 2, 3, 4, 5$. Material costs $\$0.08$ per square unit of remaining sheet.

x	1	2	3	4	5
Volume					

(a) Find the volume for every possible x.

(b) Find the value maximizing volume.

(c) Find material cost and cost per cubic unit for the maximizing box.

10.494 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Ticket-Price Investigation

A theater expects attendance to fall by 20 people for every $\$1$ increase from a $\$6$ ticket price. At $\$6$, expected attendance is 500. The theater pays a fixed $\$1{,}200$ cost and a 5% fee on revenue.

(a) Build a table for prices $\$6$ through $\$10$.

(b) Find net profit for each price.

(c) Recommend a price among the five tested prices and explain the tradeoff between price and attendance.

10.495 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Rectangle Data Investigation

Nine students choose widths $4, 6, 8, 10, 12, 14, 16, 18,$ and 20 for rectangles with perimeter 48.

Width	Length	Area
4		
6		
8		
10		
12		
14		
16		
18		
20		

(a) Find each corresponding length and area.

(b) Find mean, median, range, and MAD of the widths.

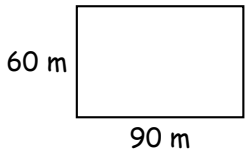
(c) Identify the area-maximizing width and explain the symmetry of paired widths w and $24 - w$.

10.496 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

School Fair

A 90 m by 60 m field uses 35% for booths. Of the booth area, $\frac{2}{7}$ is games; the rest is split food:crafts $= 3 : 2$. Food flooring costs $\$6.40$ per square meter. The fair records 640 distinct visitors, and each visitor buys exactly one game ticket. Child:adult tickets are sold in the ratio $5 : 3$ at $\$2.50$ and $\$4.00$. A random sample of 40 visitors has mean total fair spending $\$18.50$ and MAD $\$4.20$.



(a) Find all booth-category areas and food-flooring cost.

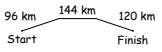
(b) Find ticket counts and revenue.

(c) Use the sample to estimate total spending by all 640 visitors and state one limitation. Report the estimated visitor spending, game-ticket revenue, and food-flooring cost separately; explain why the given information is not enough to calculate the fair's profit.

10.497 Directions:
Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Regional Field Trip

A trip has three legs of 96, 144, and 120 km traveled at 64, 72, and 60 km/h. Buses hold 48 students; 317 students attend. Admission is $\$18$ per student with a 25% group discount. Each bus uses one liter per 5 km and fuel costs $\$1.70$ per liter.



(a) Find buses needed, total travel time, and average speed.

(b) Find discounted admission cost.

(c) Find total fuel cost for all buses and the complete cost per student.

10.498 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Playground Renovation

A rectangular playground has coordinate vertices $(-6, -3)$, $(8, -3)$, $(8, 5)$, and $(-6, 5)$. Each coordinate unit represents 2 meters.

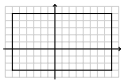
A scale model of the playground is made using a scale of $1 : 200$, meaning that 1 centimeter on the model represents 200 centimeters in real life.

Safety surfacing will cover 62.5% of the playground and costs $\$32$ per square meter. Two fundraising plans are proposed:

$$\text{Plan A: } F = 2{,}000 + 3d$$

$$\text{Plan B: } F = 5{,}000 + 2d$$

where F is the amount raised in dollars and d is the number of donors.



(a) Find the actual length, width, and area of the playground.

(b) Find the length and width of the scale model in centimeters.

(c) Find the area covered by safety surfacing and the total cost of the surfacing.

(d) Find the number of donors for which the two fundraising plans raise the same amount.

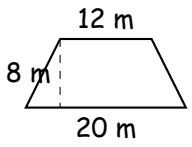
(e) At $2{,}000$ donors, determine how much each plan raises and whether each plan raises enough money to pay for the safety surfacing. Find each surplus or shortfall.

10.499 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Library Expansion

A library is a 36 m by 24 m rectangle joined to a trapezoid with bases 12 m and 20 m and height 8 m. Shelves use 40% of the area and are split fiction:nonfiction $= 7 : 3$. Flooring costs $\$21.50$ per square meter before a 12% discount. Annual checkout data are $44, 48, 51, 57,$ and 60 thousand.



(a) Find total area and each shelf-category area.

(b) Find discounted flooring cost.

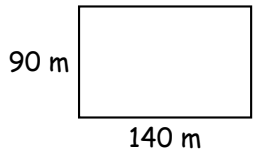
(c) Find mean, median, and range of checkouts and explain whether shelf area alone predicts circulation.

10.500 Directions:

Complete all work on separate paper. Show calculations, reasoning, and labeled diagrams as appropriate..

Campus Plan

A campus site is 140 m by 90 m. Buildings occupy 40% and cost $\$185$ per square meter. Funding plans are $250{,}000 + 35d$ and $160{,}000 + 50d$ dollars for d donors. Monthly energy outputs are $3{,}600, 3{,}900, 4{,}200, 4{,}500,$ and $4{,}800$ kWh.



(a) Find building area and construction cost.

(b) Find the donor count where the plans are equal and compare them at $8{,}000$ donors.

(c) Find mean, median, range, and IQR of energy output; recommend a funding plan and state whether either plan fully covers construction at $8{,}000$ donors.