Example Items

Mathematical Models w/Applications

Mathematical Models w/Applications Example Items are a **representative set** of items for the ACP. Teachers may use this set of items along with the test blueprint as guides to prepare students for the ACP. On the last page, the correct answer, content SE and SE justification are listed for each item.

The specific part of an SE that an Example Item measures is NOT necessarily the only part of the SE that is assessed on the ACP. None of these Example Items will appear on the ACP.

Teachers may provide feedback regarding Example Items.

(1) Download the Example Feedback Form and email it. The form is located on the homepage of Assessment.dallasisd.org.

OR

(2) To submit directly, click "Example Feedback" **after** you login to the Assessment website.

First Semester
2017–2018
Code #: 1311

$\mathcal{ACP}$ Formulas
Mathematical Models with Applications
2017–2018

Perimeter and Circumference	
Square: $P = 4s$	Circle: $C = 2\pi r$ $C = \pi d$
Rectangle: $P = 2\ell + 2w$	
Area	
Square: $A = s^2$	Triangle: $A = \frac{1}{2}bh$
Rectangle: $A = \ell w$ $A = bh$	Regular Polygon: $A = \frac{1}{2}aP$
Parallelogram: $A = bh$	Trapezoid: $A = \frac{1}{2}(b_1 + b_2)h$
Rhombus: $A = \frac{1}{2}d_1 d_2$ $A = bh$	Circle: $A = \pi r^2$
Lateral Surface Area	
Prism: $L = Ph$	Pyramid: $L = \frac{1}{2}P\ell$
Cylinder: $L = 2\pi rh$	Cone: $L = \pi r\ell$
Total Surface Area	
Prism: $S = Ph + 2B$	Pyramid: $S = \frac{1}{2}P\ell + B$
Cylinder: $S = 2\pi rh + 2\pi r^2$	Cone: $S = \pi r\ell + \pi r^2$
Sphere: $S = 4\pi r^2$	
Volume	
Rectangular Prism: $V = \ell wh$	Cube: $V = s^3$
Prism: $V = Bh$	Pyramid: $V = \frac{1}{3}Bh$
Cylinder: $V = \pi r^2 h$ $V = Bh$	Cone: $V = \frac{1}{3}Bh$ $V = \frac{1}{3}\pi r^2 h$
Sphere: $V = \frac{4}{3}\pi r^3$	
Probability	
Binomial Probability: $P(x) = \binom{n}{x} p^x q^{n-x}$	Geometric Probability: $P(n = x) = q^{n-1} \bullet p$
Permutations: ${}_nP_r = \frac{n!}{(n-r)!}$	Combinations: ${}_nC_r = \frac{n!}{(n-r)!r!}$
Binomial Coefficients: $\binom{n}{r} = {}_nC_r$	

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Coordinate Geometry

Midpoint: $M = \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$	Distance: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Slope of a Line: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$	$m = \dfrac{\Delta y}{\Delta x}$
Slope-Intercept Form of a Line:	$y = mx + b$
Point-Slope Form of a Line:	$y - y_1 = m(x - x_1)$
Standard Form of a Line:	$Ax + By = C$
Quadratic Equation: $ax^2 + bx + c = 0$	Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Equation of a Circle:	$(x - h)^2 + (y - k)^2 = r^2$

Trigonometry

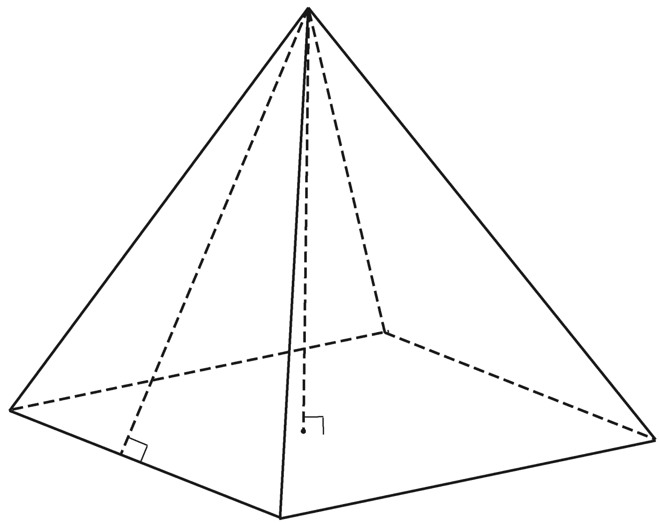
Pythagorean Theorem: $a^2 + b^2 = c^2$		
Special Right Triangles:	30° - 60° - 90° $x, x\sqrt{3}, 2x$ 45° - 45° - 90° $x, x, x\sqrt{2}$	
Trigonometric Ratios: $\sin\theta = \dfrac{\text{opp}}{\text{hyp}}$	$\cos\theta = \dfrac{\text{adj}}{\text{hyp}}$	$\tan\theta = \dfrac{\text{opp}}{\text{adj}}$
To Convert Degrees to Radians, Multiply by: $\dfrac{\pi \text{ radians}}{180^\circ}$	To Convert Radians to Degrees, Multiply by: $\dfrac{180^\circ}{\pi \text{ radians}}$	

Personal Finance

Simple Interest: $I = prt$	Present Value: $PV = \dfrac{FV}{\left(1 + \dfrac{r}{n}\right)^{nt}}$
Compound Interest: $A = P\left(1 + \dfrac{r}{n}\right)^{nt}$	Future Value: $FV = A\dfrac{(1 + r)^t - 1}{r}$
Future Value of Ordinary Annuity:	$FV = P \bullet \dfrac{(1 + i)^N - 1}{i}$
Future Value of an Annuity Due:	$FV = P \bullet \dfrac{(1 + i)^N - 1}{i} \bullet (1 + i)$
Amortization Payment:	$Amt = PV \bullet \dfrac{i}{1 - (1 + i)^{-N}}$
Annual Percentage Rate:	$APR = \dfrac{72i}{3P(n + 1) + i(n - 1)}$

HIGH SCHOOL

1 The diagram represents the Great Pyramid in Egypt.



The volume of the Great Pyramid is 18,069,333 royal cubits cubed. If a royal cubit is approximately $\frac{1}{2}$ meter, what is the volume of the Great Pyramid in cubic meters?

A 1,129,333 m^3

B 2,258,667 m^3

C 4,517,333 m^3

D 9,034,667 m^3

2 Two students conducting an experiment dropped a ball from the top of a 20-meter building. The height of the ball, in meters, is modeled by the function $h(t) = 20 - 5t^2$, where t is the time, in seconds, since the ball was dropped. What is the approximate height of the ball 1.5 seconds after it is dropped?

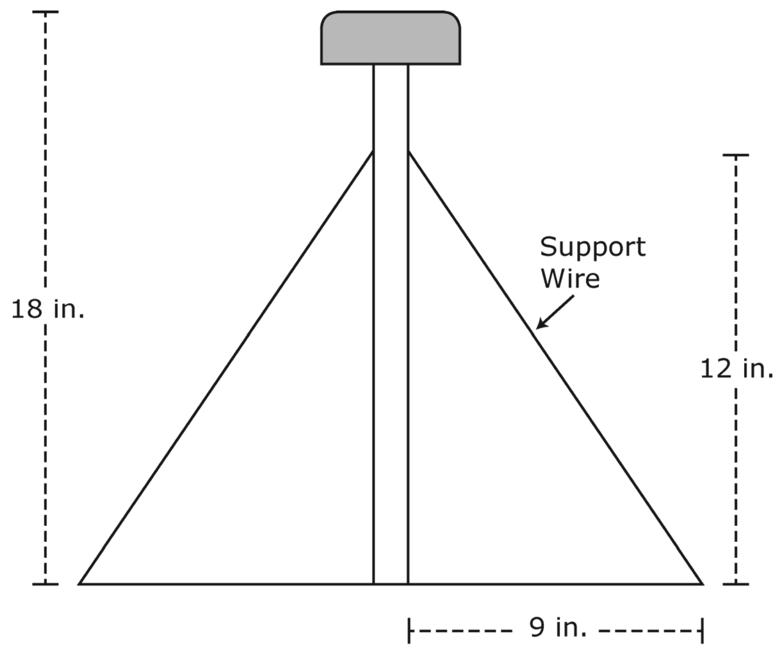
A 8.75 feet

B 15 feet

C 18.75 feet

D 20 feet

3 The model of a new cell tower is shown.



If the real tower is built with a scale of 6 inches to 25 feet, how far up the tower will the support wire reach?

A 75.0 feet

B 62.5 feet

C 50.0 feet

D 37.5 feet

4 Boyle's Law states that the pressure and volume of a gas are inversely proportional while temperature and mass remain constant. A gas has a pressure of 1.6 atm and volume of 5.2 L. If the volume of the gas changes to 2.6 L while the temperature and mass remain constant, what is the new pressure of the gas?

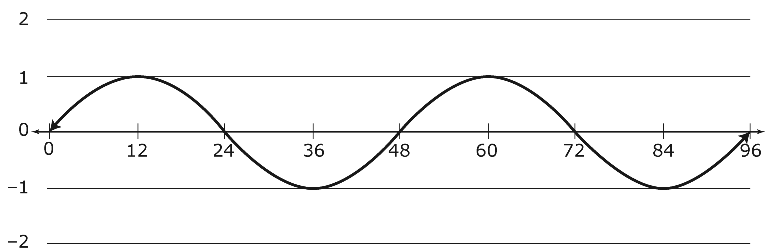
A 0.1 atm

B 0.8 atm

C 3.2 atm

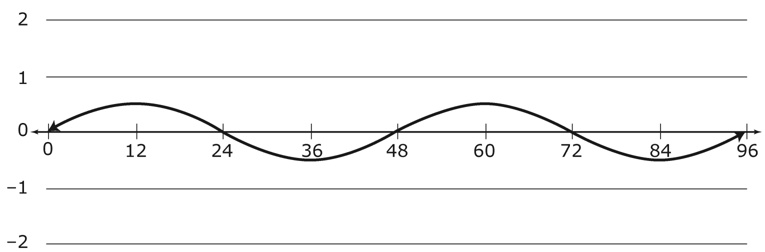
D 6.2 atm

5 The graph represents a musical note being played.

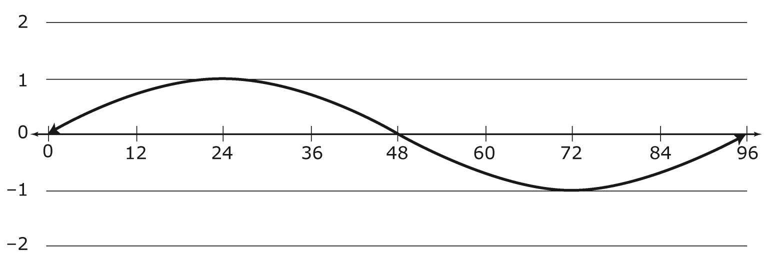


Which graph represents the same note being played at a louder volume?

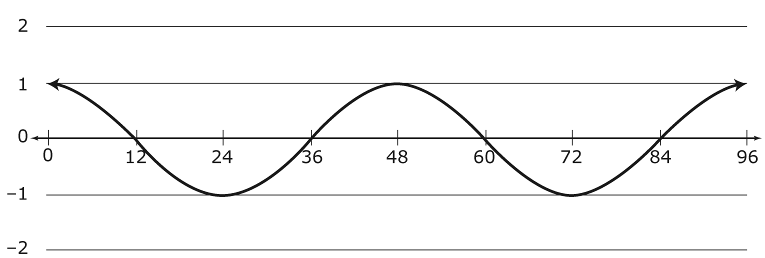
A



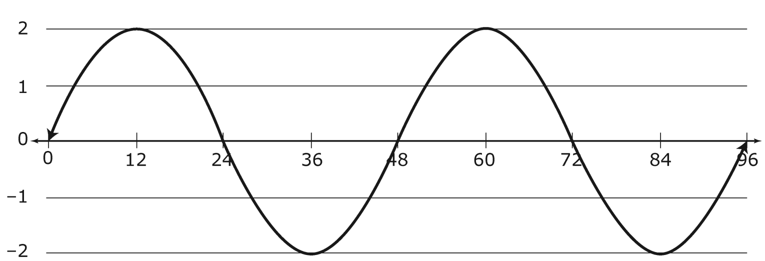
B



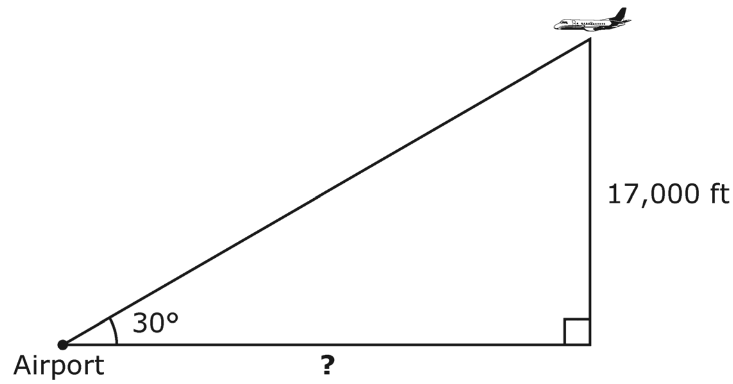
C



D



6 An airplane is sighted at 30° angle from an airport as it descends for a landing. The pilot reports an altitude of 17,000 feet.



Approximately how far is the airplane from the airport?

A 9,815 feet

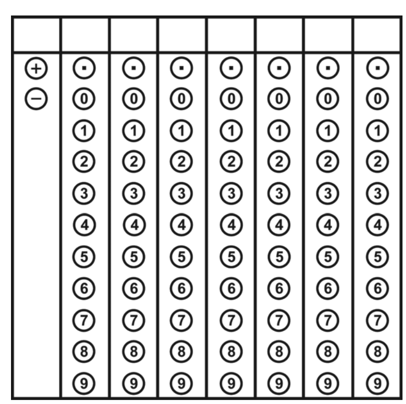
B 19,630 feet

C 29,445 feet

D 34,000 feet

7 Alex has a picture he wants to enlarge. The original picture is 8 inches wide and 10 inches high. The picture and the enlargement are similar. If the width of the enlargement is 20 inches, what is its height?

Record the answer and fill in the bubbles on the grid provided. Be sure to use the correct place value.



8 The table shows data collected by a scientist over a five-week period during a hot, rainy summer.

Week Number, *x*	Number of Mosquitoes per Square Mile, *f*(*x*)
0	400
1	600
2	900
3	1,350
4	2,025
5	3,038

Based on the data in the table, which function best models $f(x)$, the number of mosquitoes per square mile, and x, the number of weeks since the scientist began collecting data?

A $f(x) = 200x + 400$

B $f(x) = 512x + 105.7$

C $f(x) = 225(2)^x$

D $f(x) = 400(1.5)^x$

9 The data in the table represents the radioactive decay of a 90-gram sample of Strontium-90.

Number of Years	0	10	20	30
Amount of Strontium-90 Remaining (grams)	90.0	70.7	55.6	43.7

After 70 years, approximately how much Strontium-90 will remain?

A 10 grams

B 17 grams

C 21 grams

D 33 grams

10 A lake is approximately in the shape of a rectangle. If the length of the lake is about 4 miles and the width of the lake is about 1.75 miles, approximately how far would a boat travel diagonally across the lake?

A 3.6 miles

B 4.4 miles

C 5.3 miles

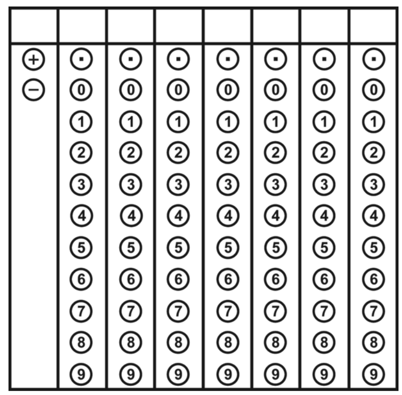
D 9.5 miles

11 Logan purchased a used pick-up truck for $18,500. The table shows the value of the truck as it depreciates overtime.

Number of Years of Ownership	Value of Truck ($)
0	18,500
1	16,650
2	14,800

If the value of the pick-up truck continues to depreciate at this same rate, what will be the value of Logan's truck after 7 years?

Record the answer and fill in the bubbles on the grid provided. Be sure to use the correct place value.



12 A sphere with a diameter of 8 inches is used as a model for a sculpture that is to be built in a local park. The scale is such that 2 inches in the model represents 18 inches in the actual sculpture. What is the approximate surface area of the actual sculpture?

A 16,286 in^2

B 4,072 in^2

C 1,810 in^2

D 1,018 in^2

EXAMPLE ITEMS Math Models Key, Sem 1

Item#	Key	SE	SE Justification
1	B	M.6B	Use scale factors with three-dimensional objects to demonstrate proportional changes in volume.
2	A	M.5C	Use quadratic functions to model motion.
3	C	M.6A	Use similarity to describe mathematical patterns and structure in architecture.
4	C	M.5A	Use proportionality and inverse variation to describe physical laws such as Boyle’s Law.
5	D	M.7A	Use trigonometric functions to model periodic behavior in music.
6	C	M.6D	Use trigonometric ratios to calculate distances as applied to fields.
7	25	M.7B	Use similarity to describe mathematical patterns and structure in photography.
8	D	M.9F	Use regression methods available through technology to model exponential functions.
9	B	M.5B	Use exponential models available through technology to model decay.
10	B	M.6C	Use the Pythagorean Theorem to calculate distances.
11	5550	M.2A	Use rates and linear functions to solve problems involving personal finance and.
12	A	M.7D	Use scale factors with three-dimensional objects to demonstrate proportional changes in surface area.