Mathematics Assessment Program *CCR-C1*

College and Career Readiness Mathematics

Scoring Rubric
(Draft)

These tests were developed with support from the Bill and Melinda Gates Foundation

Short Tasks

Q	Answer	Points
1	$x = 1$ or -4	1
2	(x= 7) length 12 cm width 5 cm	1
3	17 or –17	1
4	$2x - y = 0$	1
5	$\frac{8}{14} = \frac{4}{7}$	1
6	1. $2.7 \times 104 + 1.2 \times 102$ $= 2.712 \times 104$	1
7	a – b	1
8	$x = 32$ and $y = 8$	1
9	$-\frac{3}{4}$	1
10	Yellow: 43cm Red: 55cm Answer: Red	1
	Total	10

Multiplying Cells — Rubric

	:	Points	Section points
1.	Fills in the table correctly: Time: 0 | 20 | 40 | 60 | 80 | 100 | 120 Number of cells: 1 | 2 | 4 | **8** | **16** | **32** | **64**	2	2
2.	Fills in the table correctly: Time: 0 | 20 | 40 | 60 | 80 | 100 | 120 Number of cells as power of 2: 2^0 | 2^1 | **2^2** | **2^3** | **2^4** | **2^5** | **2^6**	2	2
3.	Gives a correct answer: **2^9** (allow 512) Gives a correct explanation such as: 3 hours is 9 lots of 20 minutes and the power of 2 equals the number of 20 minutes which have passed.	1 1	2
4.	Gives a correct answer: **32768** Shows correct work such as: 5 hours = 5x3 *lots of 20-minutes* = 15 *lots of 20-minutes* **2^{15}**	1 1	2
5.	Gives a correct answer: **340 minutes or 5 hours 40 minutes** Shows correct work such as: $2^{16} = 32768 \times 2 = 65536$ $2^{17} = 65536 \times 2 = 131072$ 17 x 20	1 1	2
	Total Points		**10**

	Sorting Functions	Rubric	
		Points	Section points
1.	Gives correct answers: Allow 1 point for each two correct answers.	6	6
2. (a)	Gives correct explanations such as: **Equation C is a quadratic curve that passes through the origin and is symmetrical about the y axis, so this is Graph A.**	1	1
(b)	**Equation D is the equation of a straight line, so this is Graph B.**	1	1
(c)	**Equation B is a quadratic curve that passes through the origin and is symmetrical about the x axis, so this is Graph C.**	1	1
(d)	**Equation A is an inverse (hyperbolic) function: the graph approaches, but does not cross the axes (the axes are asymptotes) so this is Graph D.**	1	1
	Total Points		**10**

Graph	Equation	Table	Rule
A	C	B	A
B	D	A	C
C	B	C	D
D	A	D	B

	Charity Fair	Rubric	
		Points	Section points
1.	Gives correct answer: $\frac{1}{16}$ Shows work such as: probability (all red) = $(1/4)^3 = 1/64$ probability (all the same color) = 4 x (1/64) = 1/16	1 1	 2
2.	Gives correct answer: **No** **and** May show that: If 16 people play once, they pay 16 x 25¢ = \$4 On average, 1 person wins \$5 So the charity loses. (\$4 - \$5 = - \$1) Accept alternative correct reasoning	2 ft	 2
3.	Suggests changes such as: *Change 1* Have **more colors**, say 5. Calculates prob(all the same color) = 5 x $(1/5)^3 = 1/25$ States that if 25 people play once, **the charity gains**. (\$6.25 - \$5 = \$1.25)	 1 1 1	 3
	Change 2 Have **more barrels**, say 4. prob(all the same color) = 4 x $(1/4)^4 = 1/64$ If 64 people play, **the charity gains.** (\$16 - \$5 = \$11)	or 1 1 1	or 3
	Change 3 **Increase the price** to 50 cents If 16 people play once, **the charity gains.** (\$8 - \$5 = \$3) Alternatively, **decrease the amount won** from, say, \$5 to \$3. If 16 people play once, **the charity gains.** (\$4 - \$3 = \$1)	or 1 1 1	or 3
	Total Points	**max**	**10**

	Patchwork	Rubric	
		Points	Section points
1.	Correctly completes the table: 1 point triangles , 2 points squares Size (n) / Number of triangles (t) / Number of squares (s) 1 / **4** / **0** 2 / **8** / **4** 3 / **12** / **12** 4 / **16** / **24** 5 / **20** / **40**	1 2	3
2.	Verbal rule: The number of triangles is four times the size of the cushion. **or** An algebraic rule: $t = 4n$ Explanation: Each cushion has four edges: each edge has the same number of triangles as the size. **or** From the table, as the size of the cushion increases by 1' the number of t riangles increases by 4.	1 **or** 2 1 **or** 1	3
3.	A stepwise verbal rule: The number of squares increases by 4, then 8, then 12, then 16 ....: increasing multiples of 4. **or** The number of squares + the number of triangles for any size is equal to the number of squares for the next size. e.g.: 16 + 24 = 40 **or** An algebraic rule: $s = 2n(n - 1)$ or equivalent algebraic rule. Explanations relating to the cushion design, such as the following. Stepwise rule: Each triangle of one size becomes a square in the next size. **or** Algebraic rule: Each cushion has four sections: if we put two sections together, we get two rectangles, size n by $(n - 1)$.	1 **or** 1 **or** 2 1	3
4.	Stepwise rule: continues sequence to find that when $s = 180$, t **= 40** **or** Algebraic rule: finds that when $s = 180$, $n = 10$: when $n = 10$, t **= 40.**	1 **or** 1	1
	Total Points		**10**

Square		Rubric	
		Points	Section points
1	Gives correct answer: **5** Uses the Pythagorean correctly, but incorrect answer. Attempts to use the Pythagorean Rule	3 (2) (1)	3
2	Gives correct answer: **-3/4**	2	2
3.	Gives correct explanation such as: The slope of DA = 4/3 = slope of CB The slope of AB = -3/4 Therefore the sides of the shape are perpendicular The lengths of AB and AD are 5 Therefore the shape is a square. *Partial credits* For some correct work.	5 (4) to (1)	5
	Total Points		**10**

Circles and Squares	Rubric	
	Points	Section points
Gives correct answer: The ratio of the areas of the two squares is 1:2	1	
Shows correct work such as: Draws construction lines from the center of the circle to the vertices of the small square. If the large square has side of length x, then, using the Pythagorean Theorem gives the length of the sides of the small square are $\sqrt{2}x/2$. The area of the large square is x^2. The area of the small square is $x^2/2$ Accept alternative methods.	4	
Gives correct answer: The ratio of the two areas is 1:2	1	
If a second circle is inscribed in the smaller square, using the Pythagorean Theorem gives the radius of the small square is $\sqrt{2}x/4$ The area of the large circle is $\pi(x/2)^2 = \pi x^2/4$ The area of the small circle is $\pi(\sqrt{2}x/4)^2 = \pi 2x^2/16 = \pi x^2/8$ Accept alternative methods.	4	10
Total Points		**10**

	Fun Size Can	Rubric	
		Points	Section points
1.	Gives correct answers: **15.9 - 16.0 cm** and **2.5 - 2.6 cm**.	2 x 1	
	Shows correct work such as: Substitutes in the formula $\mathbf{V = \pi r^2 h}$ to find the height of the can with radius 2cm and Substitutes in the formula $V = \pi r^2 h$ to find the height of the can with radius 5cm.	1	
	States that the can with radius 2 cm is **easy to hold** or **unstable** or **tall** and **thin:** the can with radius 5 cm is **difficult to hold** or **drink from** or **short** and **fat** or equivalent.	1	4
2.	Gives correct answers: **224.9/226.2//72π** cm^2 **235.6/239/75π** cm^2	1	
	Uses the formula $\mathbf{S = 2\pi r^2 + 2\pi rh}$ to find the surface areas of cylinders with radii 2cm and 5cm.	1	2
	Decides to find the surface area of other cylinders. Correctly finds the height and surface area of a cylinders with radii between 2 cm and 5 cm. **r = 3, h = 7.1/7, A ≈ 190.4** cm^2 **If graph drawn allow** **r = 4, h = 4.0, A ≈ 201.1** cm^2 **point for values plotted.**	1	
	States that from these results it appears that the **minimum** surface area is when the radius is **about 3 cm**.	1	
	Finds surface areas of cylinders with radii around r = 3. e.g. **r= 2.5, h = 10.2, A = 199.5** cm^2 Allow a point for each correct area **r= 3.5, h = 5.2, A = 191.3** cm^2	1	
	States that from calculations, or a graph of r/A (or h /A), the **minimum surface area** has radius **3 cm**, height **7 cm.**	1	4
	Total Points		**10**

Multiple Solutions — Rubric

	Points	Section points
1. Gives correct answers: a: **± 11** b: **0, 1** c: any values between **0 and 1** d: **0, 1** e: any value **≥ -0.3947** f: any value less than **1 except 0** g: any positive value	7 x 1	7
2. Gives correct answers with reasons such as: a. $\mathbf{x^2 = 121}$ and $\mathbf{x^2 = x}$ These are quadratic equations with two roots b. $\mathbf{(x-1)(5x^4 - 7x^3 + x) = 0}$ 5 solutions c. Gives two of: $\mathbf{x^2 < x}$, $\mathbf{1776x + 1066 \geq 365}$, $\mathbf{x^2 > x^3}$, $\mathbf{|x| > x}$	1 1 1	3
Total Points		**10**

Best Buy Tickets — Rubric

	Points	Section points
Shows correct reasoning and calculations such as the following: *May solve using algebra*		
Sure Print: The cost for n tickets in dollars is C = 2n/25	2	
Best print: C = 10 + n/25	2	
Method 1: May draw graphs and find the point of intersection, (n = 250).	4	
Method 2 (algebraic)	or	
When the two costs are equal 2n/25 = 10 + n/25	4	
n = 250	2	
Shows that when n < 250 Sure Print is cheaper When n > 250 Best Print is cheaper		10
Or *May decide to solve arithmetically*	or	or
Decides to list costs for different numbers of tickets.	2	
States that the lists show that when n = 250 the costs are equal	1	
States that when n < 250 Sure Print is cheaper When n > 250 Best Print is cheaper	2 x 1	10
Total Points		**10**

Number of tickets	Sure Print	Best Print
50	4	12
100	8	14
150	12	16
200	16	18
250	20	20
300	24	23

Propane Tanks	Rubric	
	Points	Section points
Gives correct answers and shows correct reasoning such as:		
The approximate value for the radius of the new tank is 4 feet.	1	
For the existing tank		
The volume of the cylinder is 283 or **90π**	2	
The volume of the sphere is 113 or **36π**	2	
The total volume is 396 or **126π**	1	
For the new tank the volume $V = \pi r^2 h + 4\pi r^3/3 = 10\pi r^2 + 4\pi r^3/3 = 2 \times 126\pi$		
$10r^2 + 4r^3/3 = 252$	2	
Tries different values for r		
When r = 4, V = 245.3		
When r = 5, V = 416.6		
When r = 4.1, V = 259.9	2	
Award process points if numerical errors are made.		10
Total Points		**10**