DJ for the Prom Problem (Algebra I)

ANNOTATED

STUDENT WORK SAMPLE ARGUMENTATION RESOURCE PACKET

Important note: The teachers and project members that discussed these work samples were not always unanimous in their determinations of quality. Although we might even agree on what the student did do, did not do, and strengths of the argument, there were differences in how much "weight" people put on different strengths and weaknesses. Thus, two teachers might see the same things in the student work sample, but one might want to classify the argument as, say, adequate quality and the other as low quality. This points to the importance of professional discussions and talking through the work samples with colleagues. There is no one absolute answer to whether a student work sample is high, adequate or low. Rather, trying to do the categorization leads to important conversations and helps a group clarify strengths, weaknesses, and what we value. That said, the teams reviewing these work samples had focused on argumentation for a year and had some level of shared vision for this work which we think is helpful to share and is reflected in the commentaries.

Student 2

1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.

Explain: An average prom lasts 4 hours. Assuming the prom would last between 1 and 4 hours, a chart comparing the cost of each DJ companies with the length of the prom is made below

	Music Makers	Dance Partners
1 hour	$375	$225
2 hour	$550	$450
3 hour	$725	$675
4 hour	$900	$900

① Equation for music makers = 175x + 200 = y
Equation for DP = 225x = y

Answer = If the prom was 4 hours long, both DJ companies would cost the same. However, anytime less than 4 hours would result in Dance Partners being the most cost effective, as they are cheaper each hour.

Commentary

This student's argument was categorized as **HIGH quality**.

The student claims that both DJ companies cost the same for "an average prom" of 4 hours. The evidence to support the claim is the table created for finding costs for 1 to 4 hours. The student provides an implicit warrant by setting up linear equations to model the cost of hiring each company for x hours, and provides an explicit warrant by directly comparing the costs for the prom that is on average 4 hours long.

Note that this student states explicitly that the question s/he was answering was about an average prom, which the student reasonably assumed to be about 4 hours. The justification offered fully addresses this question of the 4-hour prom. Given that the student is asked to engage this as a "real world" problem, adding "real world" constraints is appropriate, provided the constraints are reasonable and explicitly stated.

Student 10

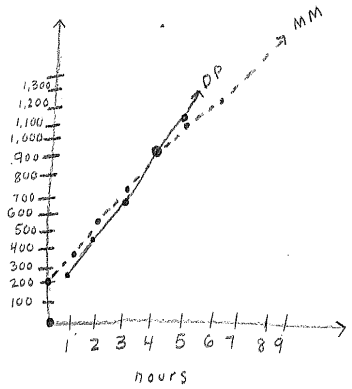
1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.

MM = 175x + 200
DP = 225x

225x = 175x + 200
-175x -175x

50x = 200
50 50

x = 4



	MM	DP
0	200	0
1	375	225
2	550	450
3	725	675
4	900	900
5	1075	1125
6	1250	1350

If the prom will last less than 4 hours they should go with Dance Partners if it will last more than 4 hours they should go with music makers, if it will last exactly 4 hours it will not matter because it will be the same price

Commentary

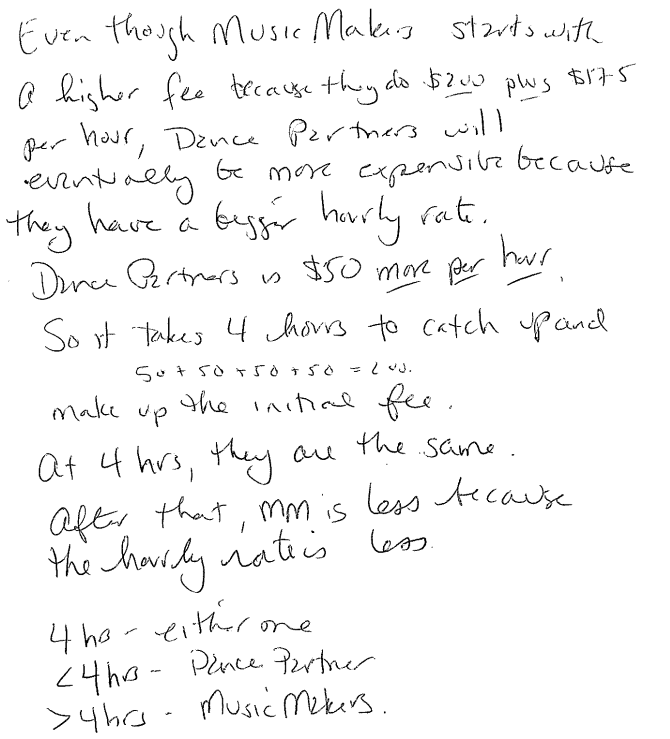
This student's argument was categorized as **HIGH quality**.

The student claims that the company that is more cost effective depends on the length of time. The student clearly explains all 3 cases. For evidence, the student provides multiple representations of evidence – a table, graph showing the point of intersection, equations with calculations deriving x = 4 (the result of setting the equations equal and solving). (Note: Not all representations are needed to support this claim. One would be sufficient.) The warrant is implicit, as the student leaves to the reader the explanation of how each of these representations shows that the costs of the two companies are equal at 4 hours. The table perhaps is the most obvious of these, with its direct comparison of the costs of both companies side-by-side.

The response could be strengthened further by using just *one* representation, and by explaining more clearly the connection between the representation and the claim.

Student 5

1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.



Commentary

This student's argument was categorized as **HIGH quality**.

The student claims that which company is more cost effective depends on the length of prom and clearly explains all 3 cases.

The evidence that the two companies cost the same for four hours is based on the $50 differential in their hourly rate and showing that 50+50+50+50=200. The warrant is based on the idea of "closing the gap:" if each hour there is a $50 difference, and there is an initial $200 difference, then it takes 4 hours to close the gap – that is, for Dance Partners to "catch up" with Music Makers.

The evidence to support the claim that Music Makers is more expensive after 4 hours is based on the hourly rates: "Dance Partners is more per hour" and MM's "hourly rate is less." The warrant is implicit: for any number of hours after the costs are equal the company with the lower hourly rate will costs less.

This argument could be strengthened by making more explicit the warrants, which could be explained more clearly.

Student 3

1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.

Music Makers - $200 + $ 175 per hour
Dance partners - $225 per hour

	MM	DP
1	375	225
2	550	450
3	725	675
4	900	900

It depends how long prom will last to see which DJ is the most cost effective. From one hour to three hours, Dance partners would be cheaper. But if prom was four hours, they would cost the same amount. And, if prom was more than 4 hours, Music Makers would be cheaper.

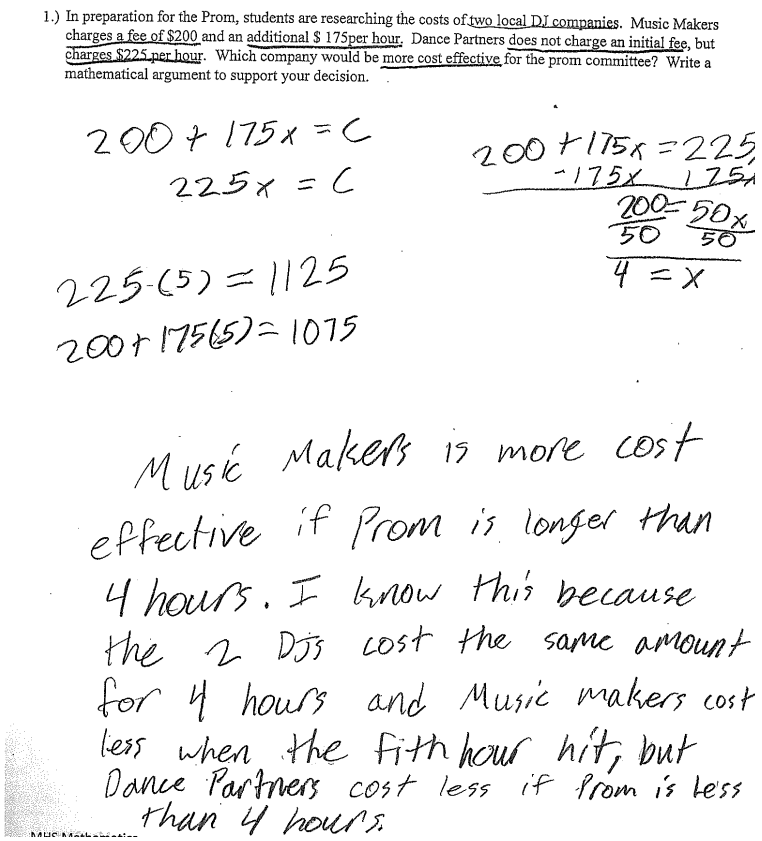
Commentary

This student's argument was categorized as **ADEQUATE quality**.

The student claims that it depends on how long prom will be and that there are 3 cases. The student provides evidence for 2 of the 3 cases (using the table), and does not provide evidence or reasoning for what happens after the costs are the same. The warrant that supports the claim is directly comparing the costs by the addition of the initial fees and costs per hour.

The argument could be strengthened if it included evidence for the cost after 4 hours, or make an argument that once the total costs is equal at 4 hours, for any prom that's longer, Dance Partners will cost more as it has a higher hourly rate.

Student 8



1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.

$200 + 175x = C$

$225x = C$

$225(5) = 1125$

$200 + 175(5) = 1075$

$200 + 175x = 225$

$-175x \quad -175x$

$\frac{200}{50} = \frac{50x}{50}$

$4 = x$

Music Makers is more cost effective if Prom is longer than 4 hours. I know this because the 2 DJs cost the same amount for 4 hours and Music makers cost less when the fifth hour hit, but Dance Partners cost less if Prom is less than 4 hours.

Commentary

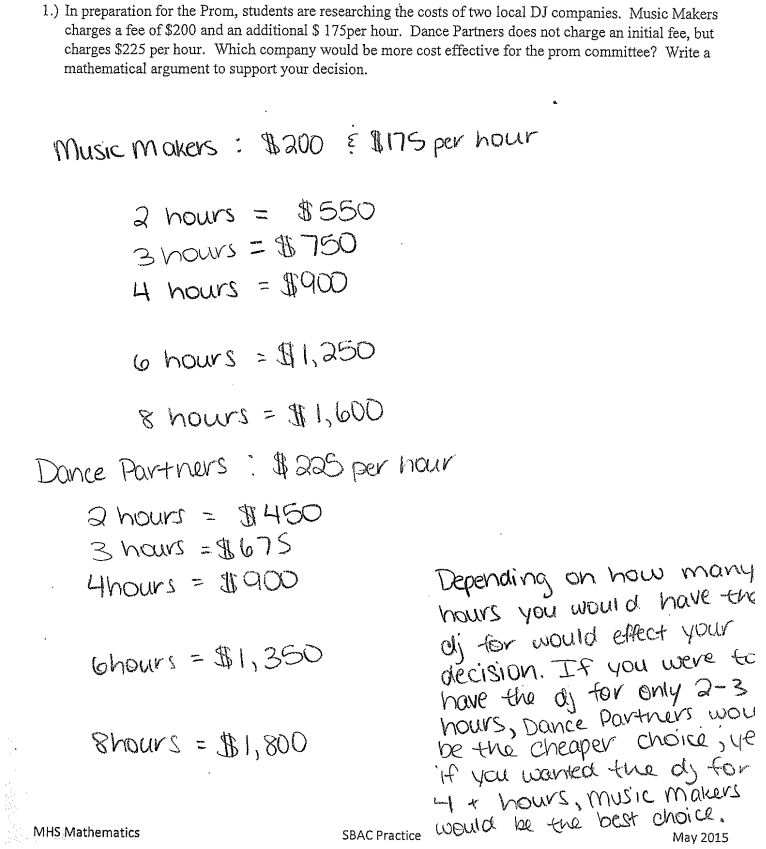
This student's argument was categorized as **ADEQUATE quality**.

The student claims that Music Makers (MM) is more cost effective if prom is longer than 4 hours. The student provides evidence for when the two companies cost the same (setting two equations equal to each other). The student also calculates the cost for 5 hours, which seems to be the evidence to support the claim that Music Makers is "more cost effective if Prom is longer than 4 hours." The student claims Dance Partners costs less if prom is less than 4 hours. No evidence is provided for this claim.

The warrants are not explicitly stated. The warrant for the costs being equal at four hours is: if both fee structures are modeled properly, and the two costs set equal, then solving finds the number of hours for which the costs are the same. The warrant that Music Makers is cheaper after 4 hours rests on knowing that the equations are linear. Linear equations do not "turn around," and so if MM is cheaper for one value (here, x=5) that is greater than the number of hours at the point of intersection (x=4), then it is cheaper for all values of hours greater than the point of intersection.

The argument could be strengthened by labeling the equations (which equation represents which company?), and by providing a reason for why the equations were set equal and why Dance Partners is cheaper before 4 hours. The argument could also be strengthened by explaining how the equations 200 + 175x=C and 225x=C represent the cost, but whether this needs to be included depends on the class and students' prior background.

Student 1



1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.

Music Makers : $200 & $175 per hour

2 hours = $550
3 hours = $750
4 hours = $900

6 hours = $1,250

8 hours = $1,600

Dance Partners : $225 per hour

2 hours = $450
3 hours = $675
4hours = $900

6hours = $1,350

8hours = $1,800

Depending on how many hours you would have the dj for would effect your decision. If you were to have the dj for only 2-3 hours, Dance Partners would be the cheaper choice, but if you wanted the dj for 4 + hours, Music Makers would be the best choice.

MHS Mathematics SBAC Practice May 2015

Commentary

This student's argument was categorized as **ADEQUATE quality**.

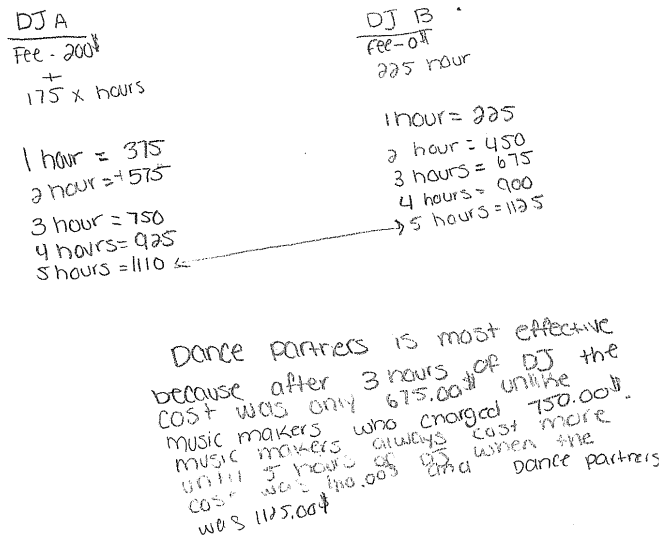
The student claims that it depends on the length of the prom. The student provides evidence of multiple cases, including showing the number of hours for which the two companies cost the same. The student does not state the companies cost the same at 4 hours even though the evidence shows that, instead claiming that MM is the best choice for 4 hours (and beyond). The warrant that supports the claim is directly comparing the costs by the addition of the initial fees and costs per hour.

The argument could be strengthened by stating that either company is cost effective at 4 hours. It could also be strengthened by either making explicit the assumption that a prom lasts at least two hours, or adjusting the claim to state that Dance Partners is better for any prom shorter than 4 hours.

Note that the Music Makers costs for 3 hours is incorrect, but this does not detract from the overall argument.

Student 4

1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.



Commentary

This student's argument was categorized as **LOW quality**.

The student has two claims: Dance Partners (DJ B) is more cost effective and Music Makers costs more until 5 hours. To support the claim that Dance Partners (DJ B) is more cost effective, the student offers an example of 3 hours and compares the costs. Similarly, to support the claim that Music Makers always costs more until 5 hours (when presumably that changes), the student compares the costs in the table, identifying the cost of each for 5 hours. Note: The evidence that supports these two claims is mathematically incorrect although the student is making the proper inferences (connecting evidence to claims). The warrant is implied (directly comparing costs by adding costs for each hour).

To strengthen the argument, the student should more clearly state the claim(s), identify who DJ A and DJ B are, and fix mathematical errors. The student should also consider what evidence helps to support the claims made.

Student 9

1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.

(plus in)

Music Makers: $175x + 200$

Dance partners: $225x$

Answer: Music Makers will be more cost effective if if you rent this company for over 4 hours. But if your renting the group for only four hours, they both will be good because they both cost $900 at 4 hours. But if you rent it for less than 4 hours, Dance Partners would be better.

Commentary

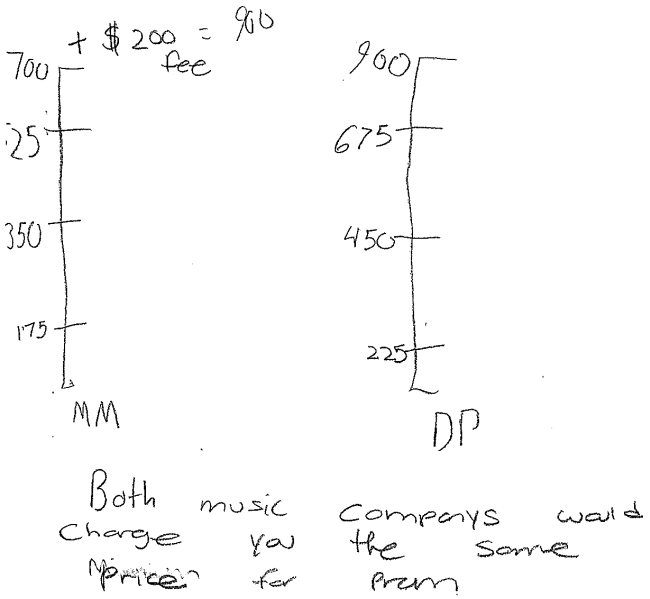
This student's argument was categorized as **LOW quality**.

The student claims that Music Makers will be more cost effective if you rent for more than 4 hours, both companies will be cost effective at 4 hours, and Dance Partners will be more cost effective before 4 hours. The evidence provided is the two equations and noting that both companies charge $900 for 4 hours. No warrant is provided that connects the evidence offered with the claims.

To strengthen the argument, the student would need to provide additional evidence, such as showing how the $900 was derived or offering some explanation for why those equations model the problem situation. The student does write "plug in" which may hint to how the $900 was derived, but this is not clear. The student should also provide evidence and reasoning to support the claim that Music Makers is more cost effective for proms longer than 4 hours and Dance Partners is more cost effective for proms shorter than 4 hours.

Student 6

1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.



Commentary

This student's argument was categorized as **LOW quality**.

The student does not make an explicit claim about which company is more cost effective, but the student makes a closely related statement, "both companies would charge you the same price for prom," and so presumably are both equally cost effective. This claim is only true if the prom is 4 hours. It could be that the student is assuming prom is 4 hours and therefore suggesting both companies are the same price. However, the assumption is not made clear.

The evidence is a chart of costs which shows the amount attributed to the hourly rates for each company, and then adds the $200 fee to the 4 hour-cost for Music Makers.

The warrant is the direct comparison of the calculated costs.

The argument could be strengthened by explicitly stating that only a 4-hour prom is being considered or by considering all reasonable cases.

The argument could be further strengthened by having the chart of costs explicitly labeled as this is not a standard representation and is left for interpretation.

Student 7

1.) In preparation for the Prom, students are researching the costs of two local DJ companies. Music Makers charges a fee of $200 and an additional $ 175per hour. Dance Partners does not charge an initial fee, but charges $225 per hour. Which company would be more cost effective for the prom committee? Write a mathematical argument to support your decision.

Music Makers: $200 (start) + $175 (per hour)

Dance partners: $0 (start) $225 (per hour)

x=5

$200 + 175x = 1075$

$225x = 1125$

I think that Dance partners Dj company would be more cost effective. I think this because no matter the amount of hours(x) it will still cost more than Music Makers.

Commentary

This student's argument was categorized as **LOW quality**.

The student claims that Dance Partners is more cost effective, and supports this by saying "no matter the amount of hours," Dance Partners will cost more. Notice the contradiction between the student saying Dance Partners is "more cost effective" and Dance Partners will "cost more than Music Makers." There may be some lack of understanding of the phrase "more cost effective."

The evidence offered (although not connected to the claim) is two equations for the fee structures of both companies (both are correct) and the cost of each company at 5 hours (also correct). No warrant is explicitly stated. For the student's claim to follow from this evidence, the warrant would be: if a company costs more for 5 hours, it costs more for any number of hours. This is a faulty inference. In addition, in this particular problem, the argument cannot be based only on the value at one point (i.e.: x=5).

The argument could be strengthened by having the equations labeled, having the claim follow from the evidence rather than suggesting that one point can tell the whole story. Alternately, the student could specify that a typical prom lasts 5 hours and use that evidence to support the claim for this typical prom.

Key Connecting Sorting Packet to Argumentation Resource Packet

Student number (Sorting Packet)	Resource Packet Sample
1	Adequate
2	High
3	Adequate
4	Low
5	High
6	Low
7	Low
8	Adequate
9	Low
10	High

Resource Packet Samples (Quality)	Student number (Sorting Packet)
High	2
High	10
High	5
Adequate	3
Adequate	8
Adequate	1
Low	4
Low	9
Low	6
Low	7