Magoosh's Complete Guide to GMAT Integrated Reasoning

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Introduction

This eBook is meant to serve as an introduction to the Integrated Reasoning section that will debut in the new GMAT on June 5th, 2012, and combines information from some of the most Integrated Reasoning-related popular posts on the Magoosh GMAT blog. If you want to know what to expect and how to prepare for this new section, this eBook is for you!

The Magoosh Team

E-mail us at support@magoosh.com if you have any questions, comments, or suggestions!

About Us

What is Magoosh?

Magoosh is an online GMAT prep tool that offers:

- Over 250 Math and Verbal videos, that's over 20 hours of video!
- Over 800 Math and Verbal practice questions, with video explanations after every question
- Material created by expert tutors who have in-depth knowledge of the GMAT
- E-mail support from our expert tutors within 24 hours
- Customizable practice sessions and mock tests
- Personalized statistics based on performance
- Access anytime, anywhere from an internet-connected device

Featured in

Why our students love us

These are some of the reviews of Magoosh posted on GMATClub. All of these students and thousands more have used the Magoosh GMAT prep course to improve their scores:

GMAT-720   May 09 | 2012

2 out of 2 people found the following review helpful

○ **gmatclub** VERIFIED REVIEW   [What's this?]

★ ★ ★ ★ ★   By rijul007 joined: October 12, 2011 | ✐ 20 | 👍 14 | non-native speaker

Improvement: N/A | **Verbal:** ★ ★ ★ ★ ★ | **Quant:** ★ ★ ★ ★ ★

This review is for: Magoosh Premium | **Location:** Online |

The video lessons were very helpful. All the GMAT topics were covered wonderfully! Also the OG video solution for maths came in handy.

The practice questions helped me a lot in finding out my weak areas. At the end of each session, it also suggested me some video lessons that helped me improving specific areas.

Another thing that really impressed me was their prompt response to my queries, be it related to specific questions or GMAT as a whole.

Magoosh played a very important role in my GMAT preparation.

I would certainly recommend this course to everyone, not just GMAT, but also for GRE.

Big fan of Magoosh   March 26 | 2012

2 out of 2 people found the following review helpful

○ **gmatclub** VERIFIED REVIEW   [What's this?]

★ ★ ★ ★ ★   By juliacollege11 joined: March 26, 2012 | ✐ 0 | 👍 0 | native speaker

Improvement: N/A | **Verbal:** ★ ★ ★ ★ ★ | **Quant:** ★ ★ ★ ★ ☆

This review is for: Magoosh Premium | **Location:** Online |

A friend of mine who was studying for the GRE recommended Magoosh, and I couldn't be happier with their service. The reason I found Magoosh so helpful is that the GMAT is all about tips and tricks: without Magoosh, I would never have felt as comfortable with the format of the test and the themes of the questions. The GMAT is unlike any test I have taken before. I just graduated college, so although I will be taking the GMAT again with more math training, Magoosh helped give me a lot of confidence because of the strategies the lessons taught me. Magoosh helped me focus on what was important so I spent more time studying the right areas, and calmed me down so that I spent less time worrying and more time studying.

Great GMAT Prep   April 03 | 2012

2 out of **2** people found the following review helpful

gmatclub VERIFIED REVIEW   [**What's this?**]

★ ★ ★ ★ ★   By qc9244 joined: February 26, 2012 | ✏ 0 | 👍 0 | non-native speaker

Improvement: N/A | **Verbal:** ★ ★ ★ ★ ★ | **Quant:** ★ ★ ★ ★ ★

This review is for: Magoosh Premium | **Location:** Online |

I have been using a combination of study materials, but out of all of them I have to say the Magoosh Premium is the best of them all. the pros of this amazing prep course I've seen include the following:

-ability to use the software anywhere, whether it be on a PC, Mac, tablet, smartphone, or any other device with internet connection
- breakdown of the topics in the tutorial section
- ability to filter specific topics to work on in the practice section
-being able to track problems answered incorrectly, correctly, and track progress
-the option to flag specific problems in order to take another look at it later
-tutorial videos that were related to the problem after you complete each problem if you feel you need another lesson on that specific topic. tip of advice for watching video; right click on lesson video below the explanation of how to solve the problem and choose option to open in new tab.I found this to be very helpful.
-good stimulator of the real GMAT through the practice portion

From 540 to 710   January 27 | 2012

1 out of **1** people found the following review helpful

gmatclub VERIFIED REVIEW   [**What's this?**]

★ ★ ★ ★ ★   By Anonymous joined: October 20, 2011 | ✏ 0 | 👍 0 | native speaker

Improvement: 170 Points | **Verbal:** ★ ★ ★ ★ ★ | **Quant:** ★ ★ ★ ★ ★

This review is for: Magoosh Premium | **Location:** Online |

In my opinion, this is a must-have for anyone studying for the GMAT. I used a combination of tools but I credit Magoosh with much of my progress because of the detailed, easy-to-follow explanations and the ease of use. There are a lot of services that offer practice questions but Magoosh helped me clearly understand what I was doing wrong and taught me strategies for how to work faster and smarter. Also, the ability to customize practice sessions by category and difficulty level was incredibly helpful when I needed to zero in on problem areas. It's really easy to log-in even for a quick 15 minutes when you have it - every minute counts.

What is Integrated Reasoning?

The GMAT Integrated Reasoning section is a new section on the GMAT, and will be introduced on June 5th, 2012. Instead of making test takers suffer even longer, GMAC, the writers of the GMAT, have decided to replace one of the essays with the Integrated Reasoning section.

As the section implies there is a fair amount of reasoning involved – most will be quant-based, though there will be some verbal-based reasoning as well.

Here are some important points to keep in mind:

- You must answer a question before moving on
- Once you answer a question you can't go back to it
- A graph or prompt may have multiple questions
- You will have 30 minutes to do 12 questions
- There will be an onscreen calculator for this new section (but not for the rest of the exam!)

What are the different parts?

Multi-Source Reasoning – "Click on the page to reveal different data and discern which data you need to answer the question."

Table Analysis - "Sort the table to organize the data so you can determine whether certain conditions are met."

Two-Part Analysis – "Select one answer from each column to solve a problem with a two-part solution."

Graphics Interpretation – "Interpret the graph and select the option from a drop-down list…"

How the Integrated Reasoning Section Differs from the Quantitative and Verbal Sections

Think about what distinguishes an effective manager from a pencil-pusher. The dutiful pencil-pusher can verify: A is a fact, B is a fact, and C is a fact. The effective manager can say, well, if we know A & B & C, it would not pay to do G, but it would be beneficial to pursue M, and it's even worth the risk to pursue W. Lots of folks can verify information. Good managers can integrate and synthesize information, weigh costs and liabilities, and come up with bold decisions for courses of action to take. That very aptly describes what the IR section is designed to assess.

Foundational skills

In terms of foundational skills, what you need to know for Integrated Reasoning is not really different from what you need to know for the Q & V sections. You need to know basic math, especially percentages and ratios, and you need to be able to interpret word problems. You need to know how to read graphs. You need to read critically and interpret, much as you do on CR and RC questions. These are the basic skills absolutely required to negotiate the IR section, but they are not really what the IR is designed to test.

Higher order reasoning

The IR section is designed to assess higher order reasoning. These skills include:

1. Integrating information, including organizing and synthesizing different kinds of information.

2. Evaluating sources of information, or evaluating tradeoffs and possible outcomes of a course of action.

3. Drawing inferences, making predictions, and identifying what further conclusions are supported by the given data.

4. Interrelating information, seeing how parts fit together in context.

5. Formulating strategy, deciding among possible plans of action.

These are all skills that managers need for success in the business world. These are skills that business school professors reinforce and assess. This is precisely why hundreds of business school faculty from around the world provided GMAC with the feedback that lead to the creation of the IR section.

Relish the challenge!

Yes, there are challenges associated with the new IR section. Ultimately, the challenges of the IR section are closely related to the challenges you will experience in business school and as a manager in the business world. These challenges, these opportunities to apply your creativity and insight to complex problems, are part of what make the business world engaging, even exhilarating, for folks. This is the exciting world you are entering, and it starts for real when you sit for the "next generation" GMAT and face the IR section. Do everything you can to prepare, so that when you face the IR section, you can bring your best to the challenge.

How will the Integrated Reasoning Section be scored?

Fact: Right now, the GMAT has a Verbal Section (75 min), a Quantitative Section (75 min), and two Analytical Writing Assessment (AWA) essays (Analysis of Argument and Analysis of Issue, 30 minutes each).

Fact: Right now, your GMAT score report tells you: (a) V score, (b) Q score, (c) a Total score (combination of your V & Q scores), and (d) AWA score.

Fact: The "next generation" GMAT will debut on Tuesday, June 5, 2012. This test will have a V Section, a Q Section, a single AWA essay, and the new Integrated Reasoning (IR) section. The sequence of the new test will be

1. AWA essay = Analysis of Argument, 30 minutes

2. IR section = 12 questions, 30 minutes

3. optional break, up to 5 minutes

4. Q section = 37 questions, 75 minutes

5. optional break, up to 5 minutes

6. V section = 41 questions, 75 minutes

Fact: the IR section consists of four question types

1. Graphics Interpretation (GI)

2. Two-Part Analysis (2PA)

3. Table Analysis (TA)

4. Multi-Source Reasoning (MSR)

Fact: All four question types will appear on everyone's IR sections.

Fact: The breakdown by question type will differ from one person's IR section to another person's only because of the experimental questions.

In other words, for the questions on which you are actually graded, which actually count toward your score, everyone will have the same breakdown by question type; extra experimental questions added to that baseline will give different people's IR sections different breakdowns.

GMAC has revealed neither what that fundamental breakdown is, nor how many of the 12 questions will be experimental. Let's take a pretend scenario, just to understand. Let's say: the graded IR questions consist of 2 GIs, 2 2PAs, 2 TAs, and 2 MSRs, for a total of eight (these are my made-up numbers). For everyone taking the test, let's say those are the eight questions that are graded. The other four questions would be experimental questions, and will be different for different users. Thus, Abe might get an IR section with 3 GIs, 3 2PAs, 3 TAs, and 3 MSRs. Betsy might get an IR section with 2 GIs, 3 2PAs, 3 TAs, and 4 MSRs. Cathy might get an IR section with 2 GIs, 6 2PAs, 2 TAs, and 2 MSRs. In each case, only the baseline eight questions count toward the score, and the others are experiments. (The numbers in this example are purely hypothetical: we have no idea what GMAC has up their sleeve.)

Here's the kicker, though. As our hypothetical friend Cathy is working through her IR section, she may start to think: Gee, I'm seeing a lot of 2PA questions! Some of them must be experimental! Quite true. The catch is, among those six 2PA questions, the two that count could be the first two, or the last two, or any combination. There are actually 15 different ways that the two that count could be scrambled among the four experimental questions. As the test taker, even if you do have strong suspicions about which question types the experimental questions were, you will have no way of knowing, as you are working on a particular question, whether it counts or is experimental. Therefore, you have to treat every single question as if it counts, same as on the Q & V sections.

Fact: The IR section is not computer adaptive. You are randomly assigned 12 questions as a group, and move through that sequence regardless of whether you are getting questions right or wrong.

Fact: The "next generation" GMAT score report will consist of (a) V score, (b) Q score, (c) a Total score (combination of your V & Q scores), (d) AWA score, and (e) IR score.

Fact: The IR score will be an integer from 1 to 8. THERE IS NO PARTIAL CREDIT ON THE INTEGRATED REASONING SECTION. For example, in a TA question in which there are three dichotomous prompts (e.g. true/false), you must get all three right to get credit for that one question. If you get at least one of the three wrong, the whole question is wrong.

Fact: The number of IR questions you get right will constitute a raw score. The GMAC, using an arcane alchemy known only to them, will convert that raw score to a scaled score (1 – 8), which will be accompanied by percentiles.

Notice: Because of the statistical magic GMAC uses in converting raw scores to scaled scores (on IR, Q, & V sections), what may seem to your advantage or disadvantage may not work out that

way. For example, the fact that there's no partial credit is challenging: it makes it harder to earn points on individual questions. BUT, harder *for everyone* means lower raw scores are needed to get a high percentile grade. Similarly, if all the questions are very easy, that means most people will get them right, which means it will be "crowded" at the top, much harder to place in a high percentile. What matters is not how inherently easy or hard the test is: what matters is how well you perform, compared to other test takers.

Multi-Source Reasoning

Format

- Split Screen
- On the left side a window with three clickable cards. These cards contain the information that will be relevant to answering the question. You can view only one card at a time.
- On the right side, the questions. You will only see one question at a time, and once you submit your answer to a question, you cannot go back. There will be two kinds of questions in the MSR section
  - Ordinary five-choice Multiple Choice, exactly like the GMAT Problem-Solving questions or any of the questions in the GMAT Verbal section.
  - Multiple Dichotomous Choice: in a single MDC question there will be three individual questions and only two answer choices from which to select (e.g "true/false", "improve/detract", "make money/lose money", etc.). In other words, for each of the three questions, you have a dichotomous choice: just two possibilities. You must answer all three correctly to get credit for this MDC question, as there is no partial credit on the IR section.

The nature of the information

Some of these questions are intensely verbal: for example, three parts of a conversation or an email exchange. Others are more numerical: for example, one card might describe the overview of a scenario, and the other two cards will give numerical parameters informing aspects of the scenario. The card that introduces the scenario may define relevant jargon or relevant abbreviations, and then the other cards will use that jargon or those abbreviations in context. The information on the three different cards can interrelate in any one of a number of ways. Again, you will be free to click back and forth among the three cards as much as you like, but at any moment in time, you will be looking at only one of the three: you cannot view cards simultaneously.

Multi-Source Reasoning strategies and tips

Don't be intimidated

The question is intended to be challenging, and in all likelihood, the context will be minimally familiar or completely unfamiliar. Relax. No matter how new or foreign it may appear, everything you need to answer the question is given.

Map, don't memorize

In Reading Comprehension, you do not need to memorize every detail of a passage: your goal on the first reading is to extract the main idea and the topic of each paragraph: this gives you a "map", and when you get to a detail question, you will follow your "map" back to the relevant section. That is very much what you will do with MSR question. You don't need to memorize: you do need to figure out (a) where the pieces of information are located, and (b) how information given on one card influences or plays into information given on the other cards.

Be careful to distinguish what must be true from what could be true.

Make sure you verify the answer to each question with concrete information on the cards.

Multi-Source Reasoning practice questions

Card #1

Whizzo Chocolate Company in Chicago, IL, makes a wide variety of exceptionally high quality confections. Each one of their products can be classified into one of 5 groups. (Weights include all necessary packaging for shipping.)

1. 12-piece assortments (1.5 lbs, $14.99), some of which require refrigerated shipping and some of which do not.

2. 20-piece assortments (2.0 lbs, $24.99), some of which require refrigerated shipping and some of which do not.

3. a small chocolate-covered fruit basket (12 lb, $39.99), which requires refrigerated shipping

4. a large chocolate-covered fruit basket (30 lb, $59.99), which requires refrigerated shipping

5. an all-chocolate chessboard with white & dark chocolate chessmen (25 lb, $149.99), which requires refrigerated shipping

Card #2

Whizzo Chocolate Company uses only the following shipping methods:

Western Food Sender

a) WFS non-refrigerated service: $50 plus $10 times each pound

b) WFS refrigerated service: $80 plus $15 times each pound

Card #3

If a single order is a "mixed order", that is, it contains both items that require refrigerated shipping and items that do not require refrigerated shipping, it does no harm to the latter items to ship them in refrigerated shipping. If a single order is a mixed order, customer has a choice:

a) only items requiring refrigerated shipping sent via refrigerated shipping , and all other items sent without refrigeration

b) all items, regardless of type, sent via refrigerated shipping

When a customer places a mixed order, the Whizzo sales representative will make this choice clear to the customer, and make clear that absolutely no damage will occur by refrigerating those items which don't require refrigeration.

The three "cards" above will simply appear one after the other. On the real GMAT (and in Magoosh), they will be clickable cards all in the view of one window on different tabs. You can see try an example online at http://gmat.magoosh.com/questions/2310/.

1. If a person in Pennsylvania has a total of $500 to spend on a Whizzo order, which of the following orders could he afford, including the cost of shipping?

five 12-piece assortments, all requiring refrigerated shipping	Yes	No
two large chocolate-covered fruit baskets	Yes	No
the all-chocolate chessboard with white & dark chocolate chessmen	Yes	No

2. For each of the following "mixed orders", each containing twenty items total, which shipping option will be less expensive?

   Option A) only items requiring refrigerated shipping sent via refrigerated shipping , and all other items sent without refrigeration

   Option B) all items, regardless of type, sent via refrigerated shipping

fifteen 12-piece assortments requiring refrigerated shipping and five 12-piece assortments not requiring refrigerated shipping	A	B
ten 12-piece assortments requiring refrigerated shipping and ten 12-pieceassortments not requiring refrigerated shipping	A	B
five 12-piece assortments requiring refrigerated shipping and fifteen 12-piece assortments not requiring refrigerated shipping	A	B

Answers and explanations

1. Answer: Yes, No, No

Base cost of five 12-piece assortment = 5 x $14.99 = $74.95.
Combined weight = 5 x 1.5 = 7.5 lb.
Refrigeration required.
Shipping cost = 80 + 15*75 = $192.50
Total cost = $74.95 + $192.50 = $267.45 -> affordable

Base cost of two large chocolate-covered fruit basket = 2 x $59.99 = $199.98
Combined weight = 2 x 30 = 60 lb
Shipping cost = 80 + 15*60 = $980 -> way over budget

Base cost of all-chocolate chessboard = $149.99
Weight = 25 lbs
Shipping cost = 80 + 15*25 = $455 -> over budget

2. Answer: B, A, A

Suppose you have a mixed order and it is all going to be sent via refrigerated shipping. That cost $80 + $15*(# of pound). Suppose some items, not requiring refrigeration, are removed from that shipment, and a non-refrigerated shipment is created. The additional cost is the $50 base cost of a non-refrigerated shipment. The savings per pound is the difference in the per pound rates: $15/lb – $10/lb = $5/lb. When will this saving exceed the additional $50 cost? When the total weight of the non-refrigerated shipment exceeds 10 lbs.

The first order has five 12-piece assortments not requiring refrigerated shipping: 5 x 1.5 = 7.5 lbs of goods not requiring refrigerated shipping. That is not enough to justify a separate non-refrigerated order.

The second order has ten 12-piece assortments not requiring refrigerated shipping: 10 x 1.5 = 15 lbs of goods not requiring refrigerated shipping. That is enough to justify a separate non-refrigerated order.

The third order has even more weight not requiring refrigerated shipping, so this one will also justify a separate non-refrigerated order.

Table Analysis

Format

- A "sortable" table of numbers --- the table will have multiple columns, and you will have the ability to sort by any column, so that is shows that column in increasing or decreasing order.
- There may be verbal information, before or after the table, describing or clarifying something about the table
- All the TA questions are "Multiple Dichotomous Choice" questions. That is, for each TA question, there will be a prompt and then three individual questions and only two answer choices from which to select (e.g "true/false", "yes/no", "wins/losses", etc.). The prompt can be quite wordy, delineating precise specifications. You must get answer all three prompts on the page correctly to earn credit for the question, as there is no partial credit on the GMAT IR.

The nature of the information

This is relatively straightforward. One column of the table may be a verbal identifier (e.g. the name of each country), but the other columns will be numerical. The numbers can be numerical values of a variable, or ranks, or percentages, or percentage increase/decrease.

Table Analysis strategies and tips

Understand the nature of the numbers in each column and their interrelationship

Some column-heading will provide completely self-evident descriptions, but if accompanying text appears, you will need to read that carefully to determine the exact meaning of at least some of the columns.

Understand the comparison in percent changes.

If one column is percent increase or percent decrease, make sure you understand what the "starting" point was and what the "final" value was. This will often be clarified in the text prompt.

Understand the value of ranks

Sometimes, in addition to the numerical value of a variable, you will also be given the "rank" of each line in terms of that variable. This can provide a number of valuable insights. For example, if two lines have adjacent ranks, then no other member, mentioned in the table or omitted, can possibly have a value of the variable between those two values. For example, say, C has variable = 152 and rank = 8, and F has variable = 98 and rank = 9; then, no member may have a value of the variable between 98 and 152. Alternately, if some ranks are missing, then you know how many members are missing in that exact range. For example, say, C has variable = 152 and rank = 8, G has variable = 174 and rank = 5, and the ranks 6 & 7 do not appear on the table: then we know there are exactly two values that do not appear between 152 and 174.

http://gmat.magoosh.com/

Table Analysis practice questions

The following two tables show the same data ranked in two different ways. (On the real GMAT, you will have sortable tables embedded in the page with the question.)

Note that "tertiary education" means all education following high school level: undergraduate as well as graduate studies. Here, "in tertiary education" includes those now enrolled in those programs, as well as all who have completed degrees. Note, also, many of the countries in the table have a high percent of total students in the table, and therefore rank considerably lower in public spending per tertiary student: countries with comparatively few students at the tertiary level rank much higher than the countries listed in the table.

Country	Percent of 20+ year olds in tertiary education	Rank, percent of 20+ year olds in tertiary education	Public spending perstudent, tertiary level	Rank, public spending per student, tertiary level
Greece	56	1	$26.70	92
Belgium	46	2	$17.60	113
France	42	3	$30.30	86
Spain	38	4	$19.80	107
United States	38	4	$29.30	97
Canada	37	6	$46.10	58
Ireland	35	7	$27.80	90
United Kingdom	33	8	$26.30	93
Poland	33	8	$20.20	106
Australia	33	8	$24.90	96
New Zealand	33	8	$25.50	95
Netherlands	32	12	$43.00	62
Finland	31	13	$39.70	66
Portugal	30	14	$28.20	88
Norway	28	15	$46.50	57
Italy	26	16	$26.00	94
Hungary	26	16	$30.50	85
Czech Republic	23	18	$33.90	75
Sweden	23	18	$53.50	51
Slovakia	21	20	$30.80	83

Country	Percent of 20+ year olds in tertiary education	Rank, percent of 20+ year olds in tertiary education	Public spending perstudent, tertiary level	Rank, public spending per student, tertiary level
Sweden	23	18	$53.50	51
Norway	28	15	$46.50	57
Canada	37	6	$46.10	58
Netherlands	32	12	$43.00	62
Finland	31	13	$39.70	66
Czech Republic	23	18	$33.90	75
Slovakia	21	20	$30.80	83
Hungary	26	16	$30.50	85
France	42	3	$30.30	86
United States	38	4	$29.30	97
Portugal	30	14	$28.20	88
Ireland	35	7	$27.80	90
Greece	56	1	$26.70	92
United Kingdom	33	8	$26.30	93
Italy	26	16	$26.00	94
New Zealand	33	8	$25.50	95
Australia	33	8	$24.90	96
Poland	33	8	$20.20	106
Spain	38	4	$19.80	107
Belgium	46	2	$17.60	113

For each of the following questions, select Yes if the statement can be shown to be true based on the information in the table. Otherwise, select No.

Yes	No	
Yes	No	1) No country with more than a quarter of people over 20 year old in tertiary programs spends more than $50/student on tertiary programs
Yes	No	2) No country that spends more than $40/student on tertiary programs has more than 40% of all people over 20 year old in tertiary programs.
Yes	No	3) No country that spends more than $20/student on tertiary programs has less than 20% of all people over 20 year old in tertiary programs.

Answers and explanations

1. Answer: Yes

"No country with more than a quarter of people over 20 year old in tertiary programs" – so these are all countries on the first table, from Hungary up. Because those are all the top-ranking countries, no country not on the chart can be in this group.

No country in this group "spends more than $50/student on tertiary programs" – the only country in our table that spends more than $50/student is Sweden, which has just under a quarter (23%) of people over 20 years old in tertiary programs. So, no country in the table meets the combined criteria, and no other countries off the table can. Therefore, the answer is Yes.

2. Answer: Yes

Start with: "has more than 40% of all people over 20 years old in tertiary programs" – these are just three countries: Greece, Belgium, and France. All three of them spend under $40/student. Therefore, no country meets the combined criteria. Therefore, the answer is Yes.

3. Answer: No

Start with: "has less than 20% of all people over 20 year old in tertiary programs." These are countries that are *not* represented in the table, because they are *below* Slovakia in their percentage of all people over 20 years old in tertiary programs. We don't have any information about where those countries fall, but clearly some of them would have to occupy ranks above 51st-place-ranked Sweden in spending per student. Sweden spends $53.50/student, so 50 countries not on the table spend more than that, and if they are not on the table, they all rank below Slovakia in their percentage of all people over 20 years old in tertiary programs. We actually can't give a definitive answer, but we certainly do not have enough information to answer Yes to the question. Because the information is unclear, the answer is No.

Two-Part Analysis

Format

- A sizeable prompt will outline the scenario. Any variables required will be defined in this prompt.
- The question consists of a table of the following form.

Question #1	Question #2	
		Answer #1
		Answer #2
		Answer #3
		Answer #4
		Answer #5

- Questions will be partially or completely related and interdependent. You will mark the answer for column #1 in the first column and the answer for column #2 in the second column. It is possible, in some scenarios, for both questions to have the same correct answer.   You cannot mark more than one answer in any column. You must get both columns correct to earn credit for the question, as there is no partial credit on the GMAT IR.

The nature of the information

The 2PA questions can be either mathematical (numerical or algebraic) or completely verbal.

The algebraic 2PA questions are quite similar to Problem Solving questions involving variables in the answer choices (VICs). The prompt will be just slightly more involved than a comparable PS prompt, and then two questions, rather than one, will be asked about that prompt.

In the numerical 2PA questions, the two numbers might be, for example, the solution values of two related variables, or two percentages that satisfy some specified condition. These are also similar to PS problems with numerical answer, except two questions are asked.

The purely verbal 2PA will typically present a paragraph-long prompt, perhaps involving technical terminology, and then the questions will pose two related tasks: first step + second step; biggest advantage + biggest liability; satisfies all conditions + satisfies none of the conditions; something gained + something lost; etc.

Two-Part Analysis strategies and tips

Determine the relationship of the two questions

Sometimes the two questions will be relatively independent or only tangentially related. Other times, how you answer one question will have direct unavoidable implications for how you answer the other.

For algebraic 2PA, review strategies for VICs in the PS Section

Remember, you can always use pure algebra, or you can plug in different numbers for the different variables (intelligent choices!) and eliminate answers that way.

For numerical 2PA, review strategies for the PS Section

You always will be able to solve directly, often using algebra or some formula, and you almost always have the option of back testing from the answers provided.

For verbal 2PA, read the questions first, and read the entire prompt carefully.

Read the questions first, so you know exactly the kind of information that will be relevant, and read with that in mind. Pay attention to what must be true, what could be true, and what absolutely can't be true.

Two-Part Analysis practice questions

At a certain corporation, N is the total number of employees. These employees can choose among a variety of benefits packages, and R% of them choose the stock option plan as their benefit package. For each employee in this plan, the corporation annually buys S shares of the company's stock. Suppose the average price per share of the company's stock is P.

On the real GMAT and in Magoosh, the table below will have bubble choices for selecting answers, but here, select answers (A) – (F), as if it were ordinary multiple choice.

The total number of shares of stock the corporation must buy annually to support this benefit package	The average monetary value of a single employee's annual benefit in this plan	
(A)	(A)	NPS
(B)	(B)	NRS
(C)	(C)	NRS/100
(D)	(D)	RSP
(E)	(E)	RSP/100
(F)	(F)	SP

Answers and explanations

left column: The total number of shares of stock the corporation must buy annually to support this benefit package.

First of all, we need to figure out the number of employees in this benefit plan. That number is R% of N, but in order to express that as an algebraic expression, we need to rewrite the percent as a fraction: (R/100)*N. That's the number of employees in the stock option plan.

Each one of those employees receives S stocks annually. If (R/100)*N employees each receive S stocks, that's a total of (R/100)*N*S = (NRS)/100. Answer: C.

right column: The average monetary value of a single employee's annual benefit in this plan

One employee receives S shares of stock. Each one has an average value of P, so the total one employee receives is SP. Answer: F.

Graphics Interpretation

Format

- This type has by far the widest variety of possible ways in which the information can be presented. All information will be presented visually, in a graph or a chart. The information may be a pie chart, a bar chart, a column chart, a line graph/timeplot, a scatterplot, a bubble graph, an organizational chart, a flow chart, or a floorplan/map
- Often there will be at least a small verbal prompt accompanying the graph or chart, and sometimes a detailed verbal explanation is given.
- One part of one chart may be detailed by another chart: for example, a single column in a column graph might be shown broken down into subdivisions in a pie chart.
- All GI questions involve drop-down menus. The question prompt will be a sentence, and at some point in the sentence there will be a gap; in the gap will be a drop down menu with 3-4 choices. For example: "The hospital's debt increased by [drop-down menu] percent in 2005" (obviously, that particular drop-down menu would have percent values). Each GI question typically will have one or two sentence prompts, always with a total of two drop-down menus. You must get both correct to earn credit for the question, as there is no partial credit on the GMAT IR.

The nature of the information

Most graphs display numerical information in visual form. The various graphs (pie, bar, column, line, scatterplot, and bubble) will account for more than 90% of all GI questions. Organizational charts will be rare: they typically show, in visual form, the power relationships, the pecking order, in an organization. Flowcharts will be rare: they map out, in visual form, the sequence of steps needed to accomplish some end, with alternatives specified at various decision points.

Graphics Interpretation strategies and tips

Estimate!

Estimation is a vastly underrated skill throughout the Quantitative Section, and it is crucially important on GI. You need not read the precise value on the graph if the value is, for example, between ticks --- as a general rule, getting in the right ballpark will be enough to determine the correct answer.   If you see the words "is nearest to", "is closed to", etc., that's a clear invitation to estimate.

Get familiar with the graph types

Practice reading the various graph types: get acquainted with what each graph does and doesn't show. Some more detailed information about particular graphs follows in this ebook. Practice reading graphs --- in the *Economist* magazine, in the *Wall Street Journal*, in the *New York Times*; any graph that appears in those news sources is an exemplar of what could appear on the GMAT.

Read all text carefully

Any verbal information that comes with the graph should not be skimmed: read it word for word, as carefully as possible. Look very carefully at how the graph is labeled (title, axis labels, etc.) --- for example, it is in amounts or percents? If there are different marks or different colored dots on the graph, make sure you understand what each one means.

Don't be afraid of the simple answer

Graphs, by their very nature, make complicated numerical relationships easy to see. That's precisely why we techy nerds love graphs. Sometimes, when you unpack what the question is asking, what it really wants you to do is something ridiculously simple (e.g. count the dots in a certain region of the graph). Don't automatically assume you are doing something wrong just because it's something a third-grader could do! That's the nature of graphs! The math is there to see!
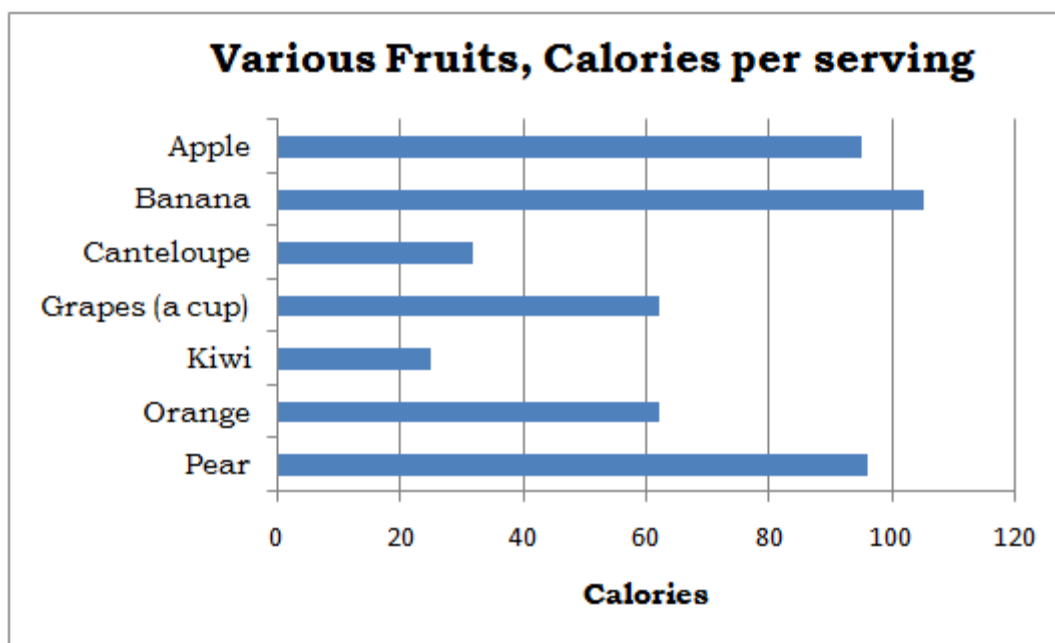
Graph Type #1: Bar Charts

Fact: One common way data will displayed on GMAT Integrated Reasoning questions is in bar charts.

This post is a whirlwind overview of what you need to know about the varieties of bar charts in order to be successful with them on the new IR section.

Bars & columns

Some sources call a graph with horizontal bars a "bar chart" and a graph with vertical bars a "column chart." Apparently, GMAC is not interested in that distinction, because the OG 13's section on IR calls graphs with vertical bars "bar charts"; presumably, if the bars were horizontal, GMAC would still call them "bar charts."

A little more is at stake here than pure semantics. Typically, when the bars are horizontal, each bar represents a completely different item from some overarching category. For example:

Various Fruits, Calories per serving

Fruit	Calories
Apple	~95
Banana	~105
Canteloupe	~32
Grapes (a cup)	~62
Kiwi	~25
Orange	~62
Pear	~95

Here, the bars are different fruits. Why these fruits were selected, and not others, is not obvious. The order here is simply alphabetical, as there is no pre-determined way to put fruits into "order", whatever that would mean. If there is no inherent order to the categories, and the

representative chosen do not exhaust the category, then the data typically would be displayed in horizontal bars, what many sources would call a "bar chart."

If the set has an inherent order to it (days of the weeks, months of the year, etc.) and/or the representative shown constitute all in the category, the data typically would be displayed in vertical bars, what many sources would call a "column chart", but which GMAC appears to still call a "bar chart." For example:

Sales over a five week period, by day of week

Day	Sales
Monday	~36000
Tuesday	~34000
Wednesday	~44000
Thursday	~42000
Friday	~28000
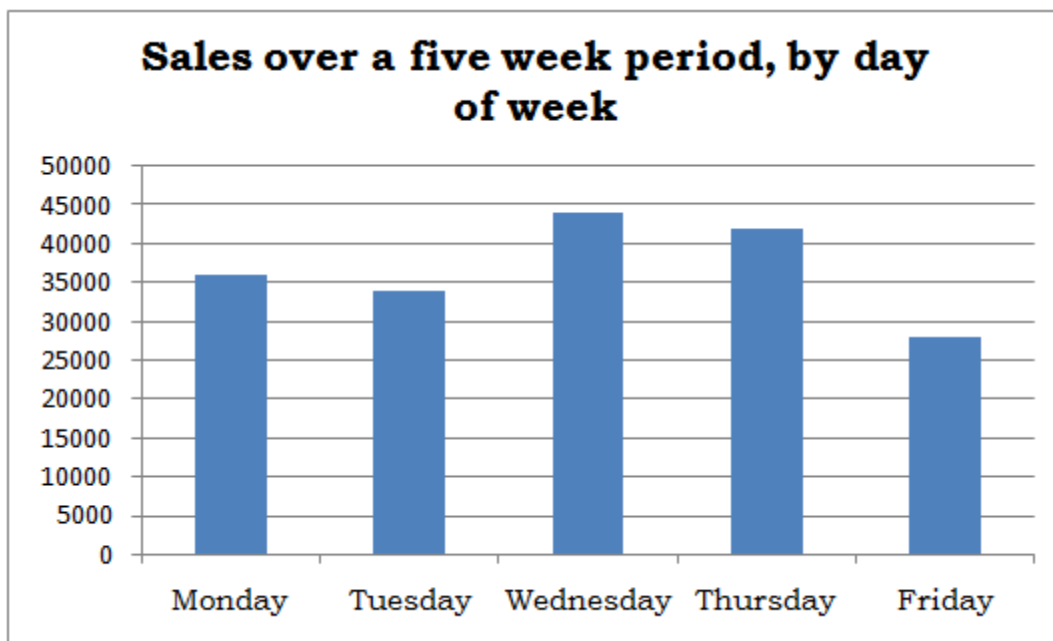
Here, days of the week have a well-defined order, in which they are displayed. Assuming this business only operates during weekdays, this is also a complete set of all the days on which they do business. That's why the vertical columns are used.

Segmented Bars & Columns

This is a more detailed chart of the "sales by day of week" chart given above.
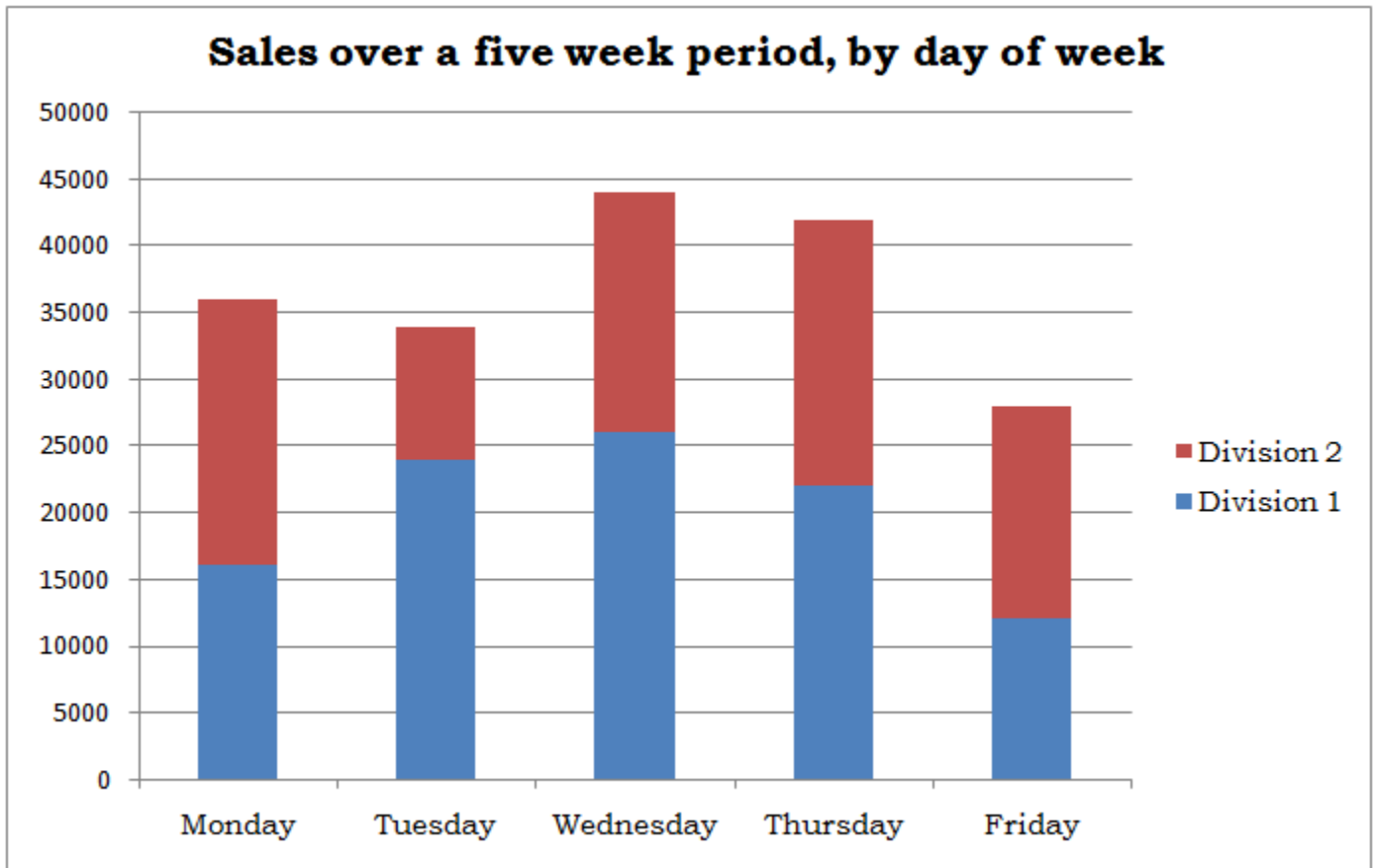
This one gives more nuanced information. Apparently, this company has two divisions, and how each division performs during different days of the week varies considerably. For example, Division 1 clearly has its best days on Wednesdays, while for Division 2, Mondays and Thursdays appear to be close to tied for best days. Here, the individual pieces are displayed as segments of a column because we might be interested in knowing either the revenues of either division separately or the total revenues of the company, which equals the sum of the revenues of the two divisions.

Clustered Bars & Columns

Sometimes we care about the sum of the parts, and sometimes we don't. If, instead of being two divisions of the same company, those same data were interpreted as the revenues of two different companies competing in the same market, then the sum of the revenues would be virtually meaningless. In this case, the columns or bars are "clustered", that is to say, displayed side-by-side. For example:
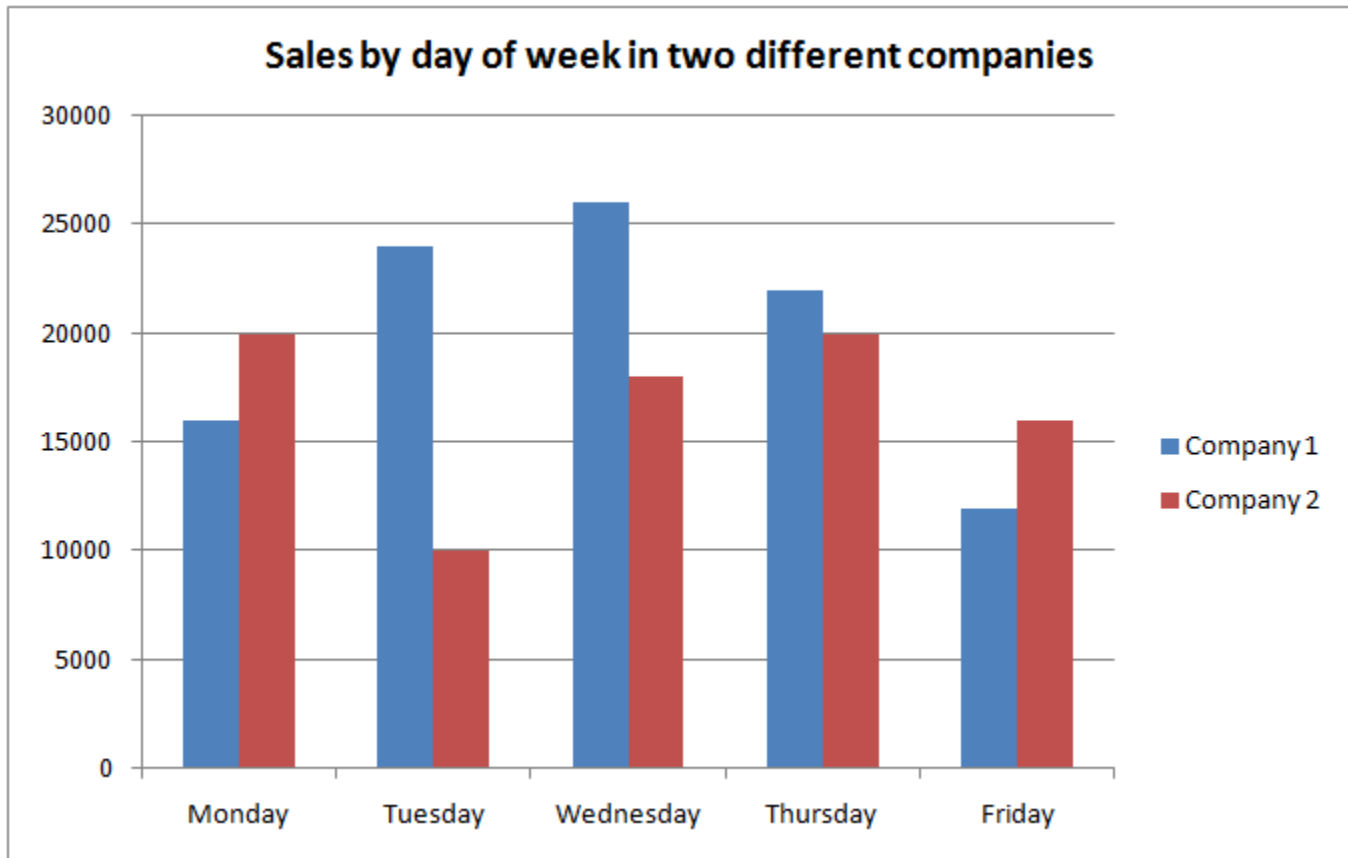

Here, the side-by-side comparison makes it very easy to compare which company outperforms the other on each day of the week.

Graph Type #2: Scatterplots

One of the most common types of graphs is statistics and in the quantitative sciences is a scatterplot. A scatterplot is a way of displaying <u>bivariate</u> data: that is, data in which we measure <u>two different variables</u> for each participant. For example, suppose we ask several people both their age & their weight, or both their annual income & the amount of debt they carry, or both their number of kids and number of credit cards; suppose we measure for several cars both the weight and the gas mileage; suppose we measure for several public traded companies both the annual revenue and the price, per share, of their stock; etc. In all of those cases, each individual (each person, each car, each company) would be a single dot on the graph, and the graph would have as many dots as individuals surveyed or measured.

An example of a scatterplot

Below is a scatterplot on which the individuals are countries. Each dot is a country.
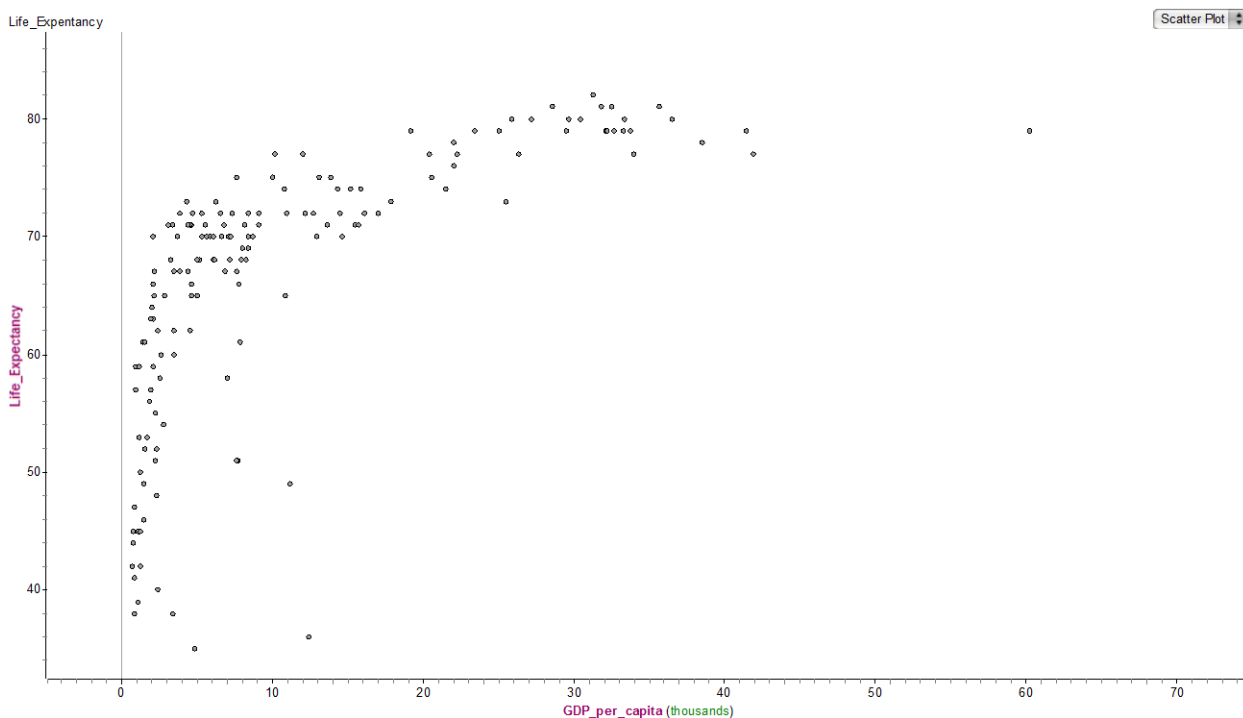
On this graph, the x-axis is the GDP-per-capita of the country. The GDP (Gross Domestic Product) is a measure of the amount of business the country conducts: the size of this depends on both the inherent wealth of the country and the population. When we divide that by the population of the country, we get GDP-per-capita, which is an excellent measure of the average wealth of the country. The y-axis is life-expectancy at birth in that country. The sideways L-shape tells the

story: For countries with a GDP-per-capita above $20K, life-expectancy at birth is between 70 and 80 years, but for the poor countries, those with a GDP-per-capita less than about $20K, life-expectancy at birth varies considerably, and is in many cases considerably less than the 70+ years that is standard for most of the world.

Now, as an example of a scatterplot with two different marks on the graph, here the same graph again, with some of the points marked differently.
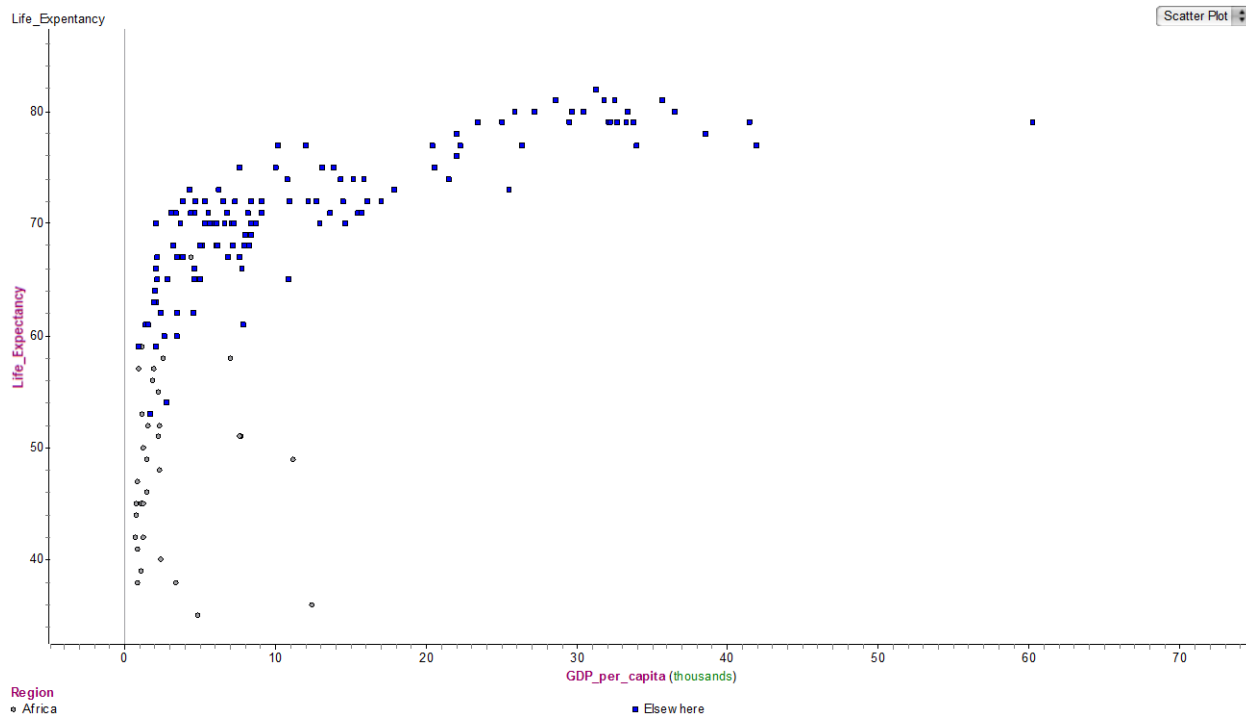

On this graph, the grey circles are countries on the continent of Africa, and the blue squares are countries in the rest of the world. Notice that essentially, the entire continent of Africa is in the "vertical arm" of the L on the left side, while the rest of the world predominantly makes the "horizontal arm" of the L at the top of the graph. In other words, if you are born in Africa, your odds from birth are far worse than if you are born anywhere else on the planet. The international social justice implications of this are staggering, and well beyond what I can discuss here. Suffice it to say: displaying data in a scatterplot can make truly important information visually apparent.

Scatterplots, Part II: Correlation and trend lines

One reason we graph data in a scatterplot is because we are looking for patterns. The simplest of all possible patterns to find on a scatterplot is a straight line pattern.
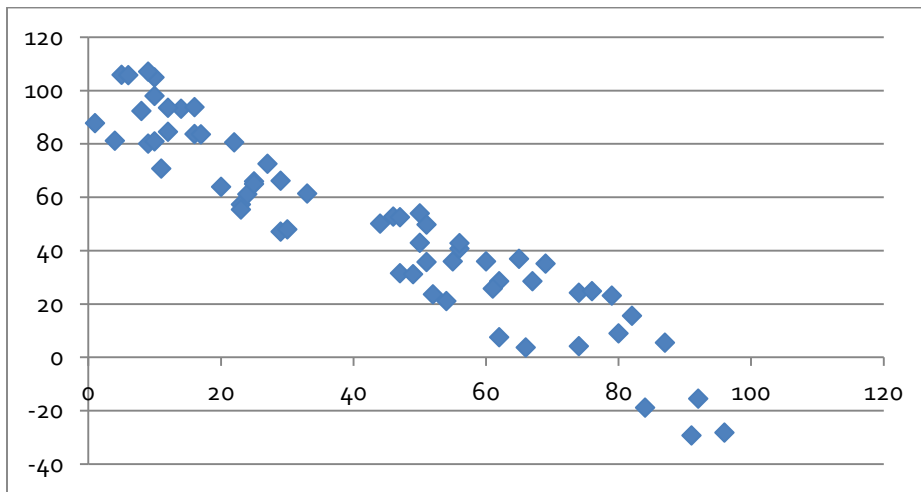
Correlation

When the points on a scatterplot lie more or less in a straight-ish line, that is called correlation. When it's a straight line with a positive slope, going up to the right, that's positive correlation, and when it's a negative, slop, that's negative correlation. To say that A and B have a positive correlation is to say that when A goes up, B goes up. Here's an example of a graph with a very strong positive correlation.
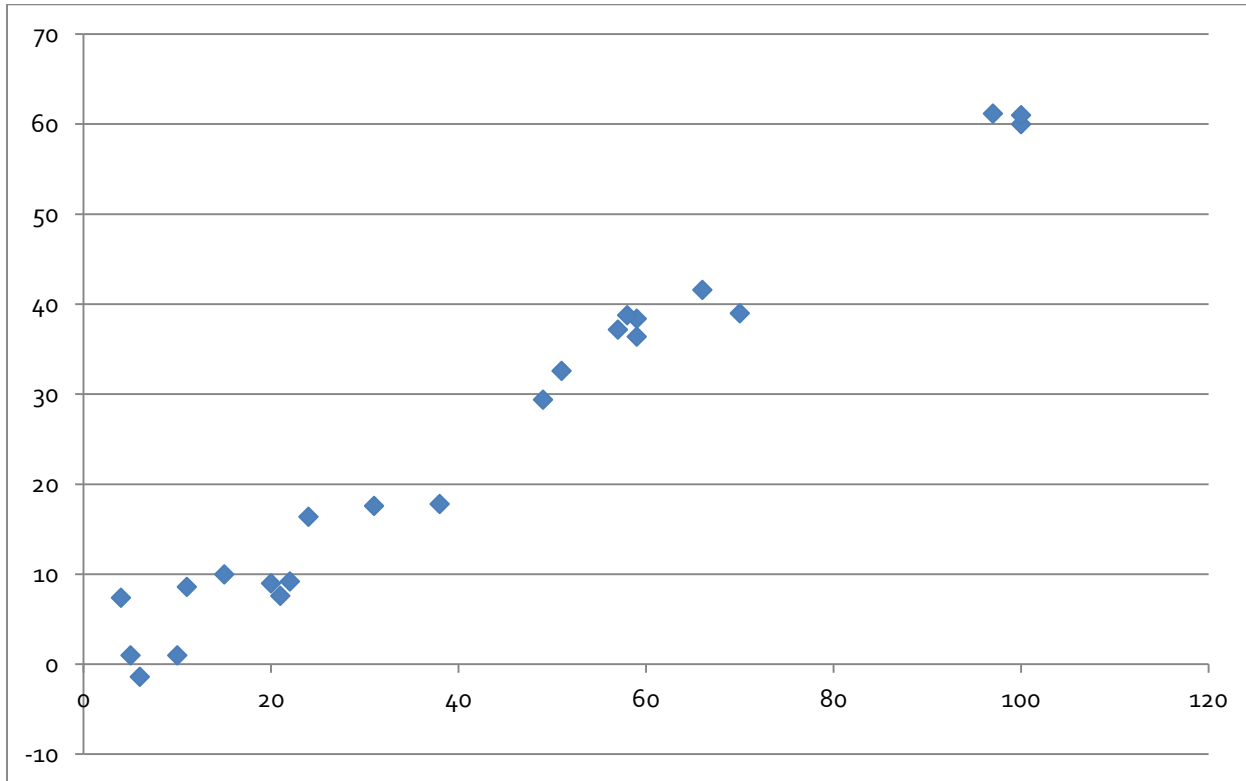
Notice, the points are not perfectly in a line, but the upward trend is unmistakably clear. In the real word, examples of variables that are positively correlated are price of crude oil per barrel & price of a gallon of gasoline; number of automobiles in a municipality & number of traffic lights in that municipality; daily temperature & daily ice cream sales; etc.

Here's another example graph, with a very clear negative correlation.

Again, the points do not line in a perfect straight line, but the downward trend is clear: when the x-axis variable goes up, the y-axis variable does down. In the real word, examples of variables that are approximately negatively correlated are unemployment rate & the Dow Jones average; torque of a car's engine & its fuel efficiency; a baseball pitcher's career ERA & number of career shutouts; etc.

Those two graphs were, by statistical standards, quite "pretty": the pattern is very clear, and little of real-world messiness is evident.

Here's some real-world data, exploring that last baseball point: a baseball pitcher's career ERA vs. his number of career shutouts.
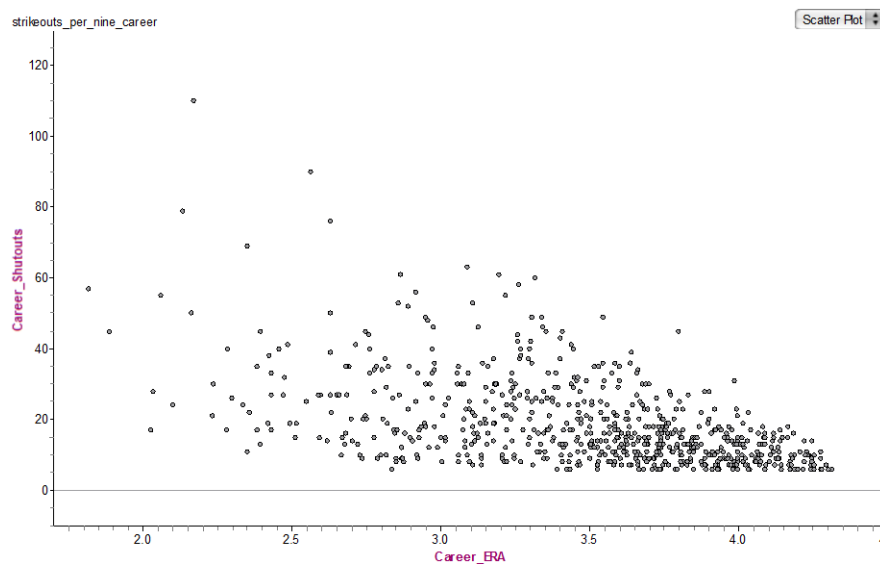
This graph only includes career leaders (in the top 1000) in both stats. It's much messier than the previous graphs, but the negative trend is still apparent. BTW, that single dot way up at the top, with Career Shutout = 110, is the great Walter Johnson, easily one of the finest pitchers of all time.
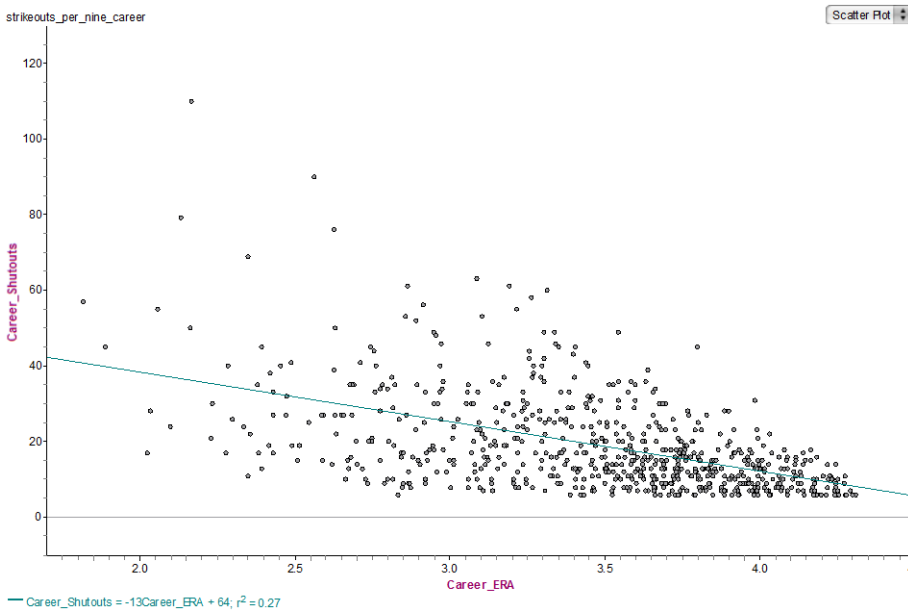
Trend lines

For the first two graphs, we can easily imagine the straight line that would go through these points and summarize them. It's somewhat less clear exactly where it would lie on the third "messy graph. This line, which summarizes the implicit linear trend in a scatterplot is called alternately a "trend line" or a "line of best fit." The official name in statistics is a "least square regression line", but the exact details about how it is calculated and all its technical properties are well beyond what you need to understand for the GMAT.

Here's the second graph again, with a trendline.
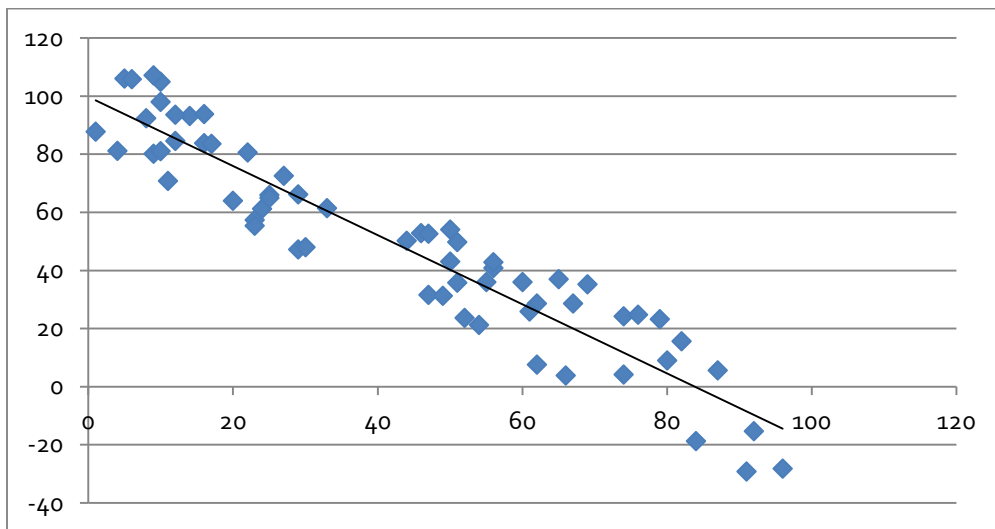
The trend line moves through the center of the linear pattern. Here, the points are negatively correlated, so the trendline has a negative slope.

Here's the baseball graph with its trend line.

strikeouts_per_nine_career

Career_Shutouts = -13Career_ERA + 64; $r^2 = 0.27$

The trendline allows us to make prediction of a typical data point. For example, here, if a pitcher has a career ERA of about 3.50, we would expect that pitcher to have, on average, about 20 career shutouts. Pitchers above the trendline got more shutouts than expected for their ERA, and pitchers below the trendline got fewer shutouts than expected for their ERA. Making a predicted y-value for a hypothetical x-value, or judging whether an individual point has a higher or lower "typical" y-value, given its x-value --- this is about all the trendline analysis the GMAT will expect of you.

Graph Type #2b: Bubble Charts

A bubble chart is a close cousin to a scatterplot. For example, here's a scatterplot:
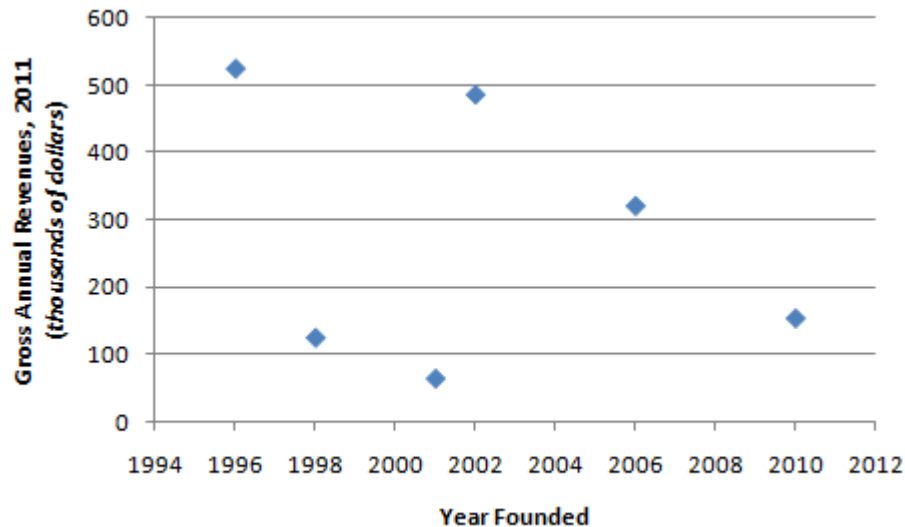
Each dot on this scatterplot is a company. The vertical position of the dot tells you the 2011 revenue of the company. The horizontal position tells you the year the company was founded. For example, there's a company founded in 2001 that has revenues under $100K — it appears to have had 2011 revenues of around only $70K, the lowest of the six companies shown. It appears the oldest company did quite well, but then the next two oldest companies have come nowhere close to the success of the older company, while some of the younger companies have done much better. This data makes us curious: after the oldest company, why were the next two companies relatively unsuccessful, but later companies were relatively successful?

The Added Dimension of Bubble Charts

On a bubble chart, the center of the "bubble" is exactly like a dot on a scatterplot — it shows you the value of a horizontal and vertical variable. The size of the bubble adds a third variable. In fact, the very point of bubble charts to display data points, each of which has a value in each of three different variables. Bubble charts provide a quick way to visually display what is going on with three different variables at once.

Below is a bubble chart based on the same data. Notice: the vertical and horizontal variables are identical, so the centers of the bubbles in the chart below are exactly the same as the locations of the dots in the chart above. In this new graph, the size of the bubble introduces a new variable: number of employees.
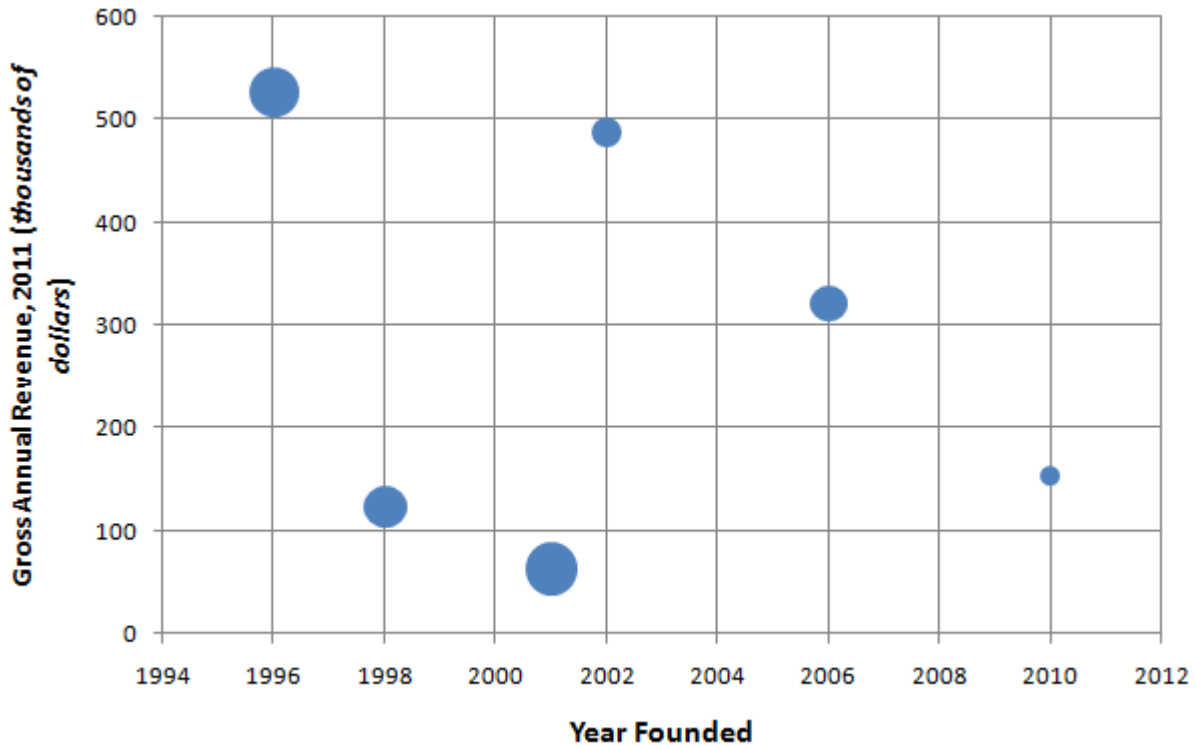
Just for a sense of scale, I'll say that Company A (the oldest, founded in 1996) has 78 employees, and Company F (the youngest, founded in 2010) has 12 employees.

Notice how much more nuanced the story becomes now. Company A was founded first: it's the oldest, with the largest 2011 revenues and the second largest number of employees. The next two companies were also relatively large companies, and they didn't do well. By contrast, the fourth company, founded in 2002, is a very small company, and it has almost caught up to Company A in terms of revenue. We don't know how this small company manages to do what it does with so few employees — a vastly superior product? the brilliant use of technology? Obviously, there's more to the story, but notice how the size of the bubbles added a whole other dimension to the story.

Graphics Interpretation practice questions

The following graph shows the annual revenues of two companies, close competitors in the same market, over a recent six year period.
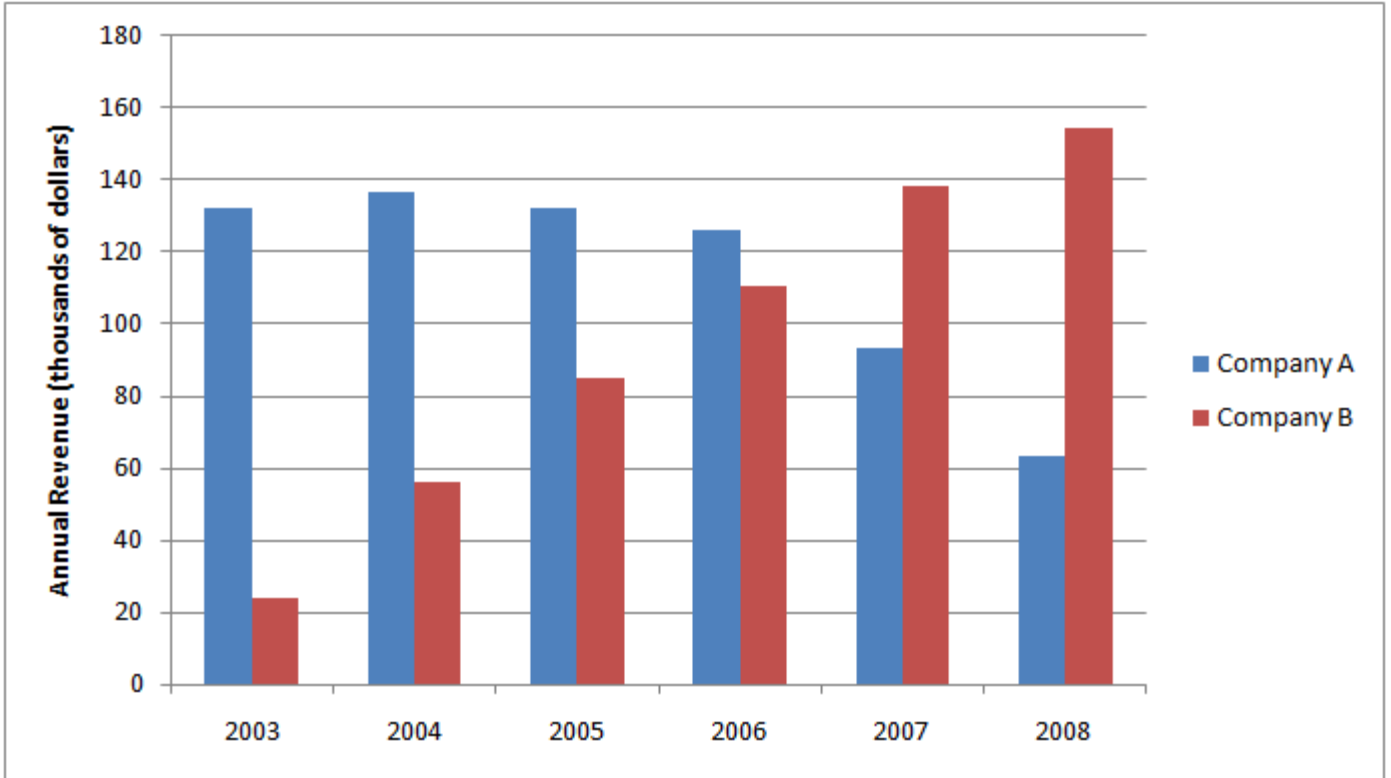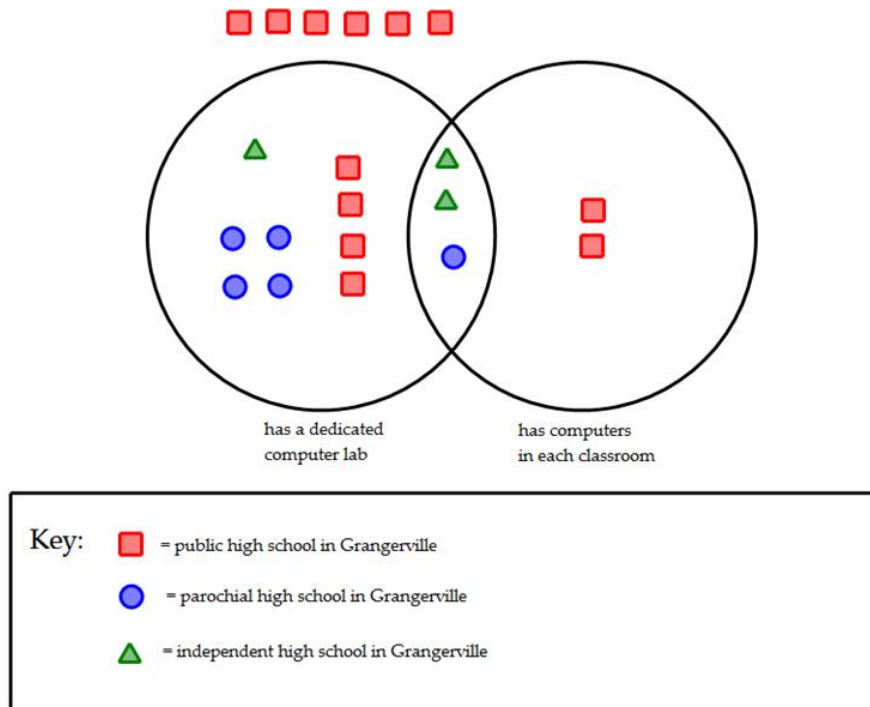

1) Of the years shown, in the first year that Company B's revenues overtook Company A's revenues, how much more money did Company B earn that year?

A. $45,000
B. $63,000
C. $91,000
D. $108,000
E. $138,000

2) What was the percentage decrease in Company A's revenue from 2007 to 2008?

A. 4.5%
B. 11.4%
C. 26.2%
D. 32.2%
E. 55.7%

has a dedicated
computer lab

has computers
in each classroom

Key: ■ = public high school in Grangerville

        ● = parochial high school in Grangerville

        ▲ = independent high school in Grangerville

The chart above shows the technology capabilities of the 20 existing high schools in Grangerville.

3) If a Grangerville high school with either a dedicated computer lab or a computer in every classroom is chosen, the probability that it will be a public school is:

A. 20%
B. 33.3 %
C. 40%
D. 42.9%
E. 44.4%

4) Which of the following statements is true?

I. Independent schools constitute the high percentage of high schools in Grangerville with both a dedicated computer lab and a computer in every classroom
II. Public Schools are tied for the highest percentage of high schools of Grangerville with a dedicated computer lab.
III. Public Schools constitute the highest percentage of high schools of Grangerville with either a dedicated computer lab or a computer in every classroom.

A. I only
B. II only
C. III only
D. I and II
E. I and III

Answers and explanations

1. Answer: A

This is a slightly trickier question. First, we need to identify the first year in which Company B's revenues overtook Company A's revenues. This would be the first year on the chart for which the red column is higher than the blue column. The first time this happens is 2007. In 2007, A made something just above $90K, say $93K, and B made something just below $140K, say $138K. We want to know how much more Company B earned, so we subtract: $138K – $93K = $45K, and this is answer A.

2. Answer: D

In 2007, A made something just above $90K, say $93K. In 2008, A made something just above $960K, say $63K. For approximation purposes, let's just round these to $90K and $60K respectively. If the revenues went from $90K in 2007 to $60K in 2008, that's a drop of $30K, which is one-third of the starting value $90K. One-third as a percent is 33.3%, so the percentage decrease is going to be something very close to 33.3% percent. The only close answer choice is 32.2%.

3. Answer: D

There are 14 schools in one of the two Venn circles – those are the schools either with dedicated computer labs or a computer in every classroom. Of those schools, 6 are public: the four red squares in the left Venn circle, and the two in the right Venn circle. 6/14*100 = 42.9%.

4. Answer: E

Evaluate the statements one by one. *Statement I:* Independent schools constitute the high percentage of high schools in Grangerville with both a dedicated computer lab and a computer in every classroom. Schools with both a dedicated computer lab and a computer in every classroom are the overlap region of the two Venn circles. There are three schools in that region, and two are independent, so independent schools constitute the majority of that region. Statement I is true.

Statement II: Public Schools are tied for the highest percentage of high schools of Grangerville with a dedicated computer lab. The schools with a dedicated computer lab are the left Venn circle, the whole of the circle including the overlap region. In this circle, there are 12 schools —- 5 parochial, 4 public, and 3 independent. Therefore, parochial schools only constitute the highest percentage of that region, and public schools are a clear second. Statement II is false.

Statement III: Public Schools constitute the highest percentage of high schools of Grangerville with either a dedicated computer lab or a computer in every

classroom. Schools with either a dedicated computer lab or a computer in every classroom constitute the combined area of the two Venn circles. There are 14 schools in that region —- 6 public, 5 parochial, and 3 independent. Public schools constitute the majority of that region. Statement III is true.

Magoosh and Integrated Reasoning

Magoosh has practice questions, video explanations, and lesson videos for each of the question types in the Integrated Reasoning section. Below is an example of a Graphics Interpretation question:

You can try this question online at http://gmat.magoosh.com/questions/2295/

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