

Towards University Readiness

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Thanks to: Dr. R. Mason (Education), C. Paquette (Statistics)



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Questions to address:

○ How are students *preparing themselves* for university mathematics?



○ How are schools *preparing their students* for university mathematics?



How are students *preparing themselves* for university mathematics?

- A longitudinal study by Ralph Mason and Janelle McFeetor highlighted some students' thoughts and experiences of high school students and their views on preparing – both within class and through course selections – for university mathematics...
- 3 themes emerged regarding the topic of university readiness:
 - The importance of *achievement vs understanding*.
 - Future costs and benefits of present choices.
 - Information (or lack of it) regarding university.

The importance of *achievement vs understanding*:

- “If it’s higher even if it says you did IB math, they look at your mark, they don’t look at that you did IB math. they don’t look that you did IB English, you know they look at your mark.”
- “My teacher in grade 10 told me she’s like if you want to go into IB you can. But they don’t look that you took IB. They look at your mark.”
- “Like the reason I dropped out of Precalc math was because I had 25% of the mark. I just found it really difficult and now in Applied, it’s still a little bit difficult, I can do it but it’s not as difficult. Just because I don’t think I need Precalc it would be nice to have it. It just leaves options open because like I said I don’t know what’s going to happen.”

Future costs and benefits of present choices:

- “Like if you take the regular program you can basically finish high school first semester grade 12. Right and if I could redo my entire high school that’s what I would have done. And I couldn’t do it because of IB every other day and its all year.”
- “I’ve heard that Calculus if you take it in high school without any kind of or in university without any kind of high school foundation is absolutely brutal so even though I’m not getting a credit for it, if I take it university at least I’ll be slightly prepared.”
- “I think I would go into Precalculus just to try it out because like at one time I wanted to try business and for business you need Precalculus and just because to me Applied seemed easy so I could have took Precalculus and if it was too hard then I I could drop down but once you’re in Applied you can’t really go up.”

Information regarding university:

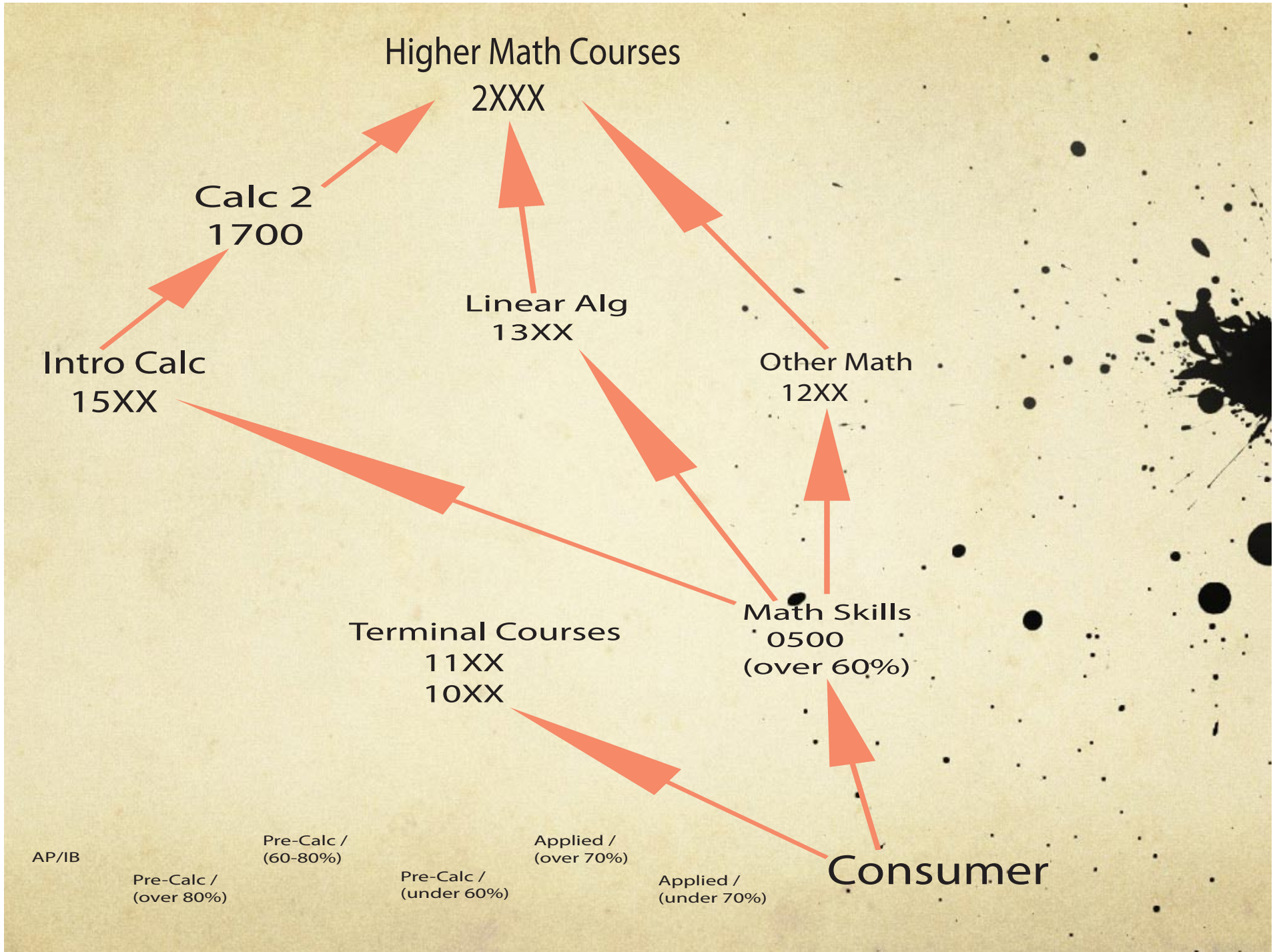
- “I chose Consumer and when I came to the like the open house at the school, a lot of the teachers actually said that Consumer was more of a course that you’ll actually use in life. ... Even though this year has been hard for some reason when I think about university I still want to go into a science general.
- “Not really. Yeah there hasn’t been much about university that my teachers have told us at all really. ... there hasn’t really been very much that’s prepared me for university at all. I still don’t know much about how it works or anything. So kind of walking in blind.”
- “I really think that at some point during high school preferably in grade 11 before the big rush like I need to find a university people need to sit down and tell you what all the university stuff means. ...Like they don’t tell you how many courses you can take in university, like they don’t tell you how it works. Because it seems to me that it’s a system a lot different from what we do here and no one bothers to tell you what it’s like.”

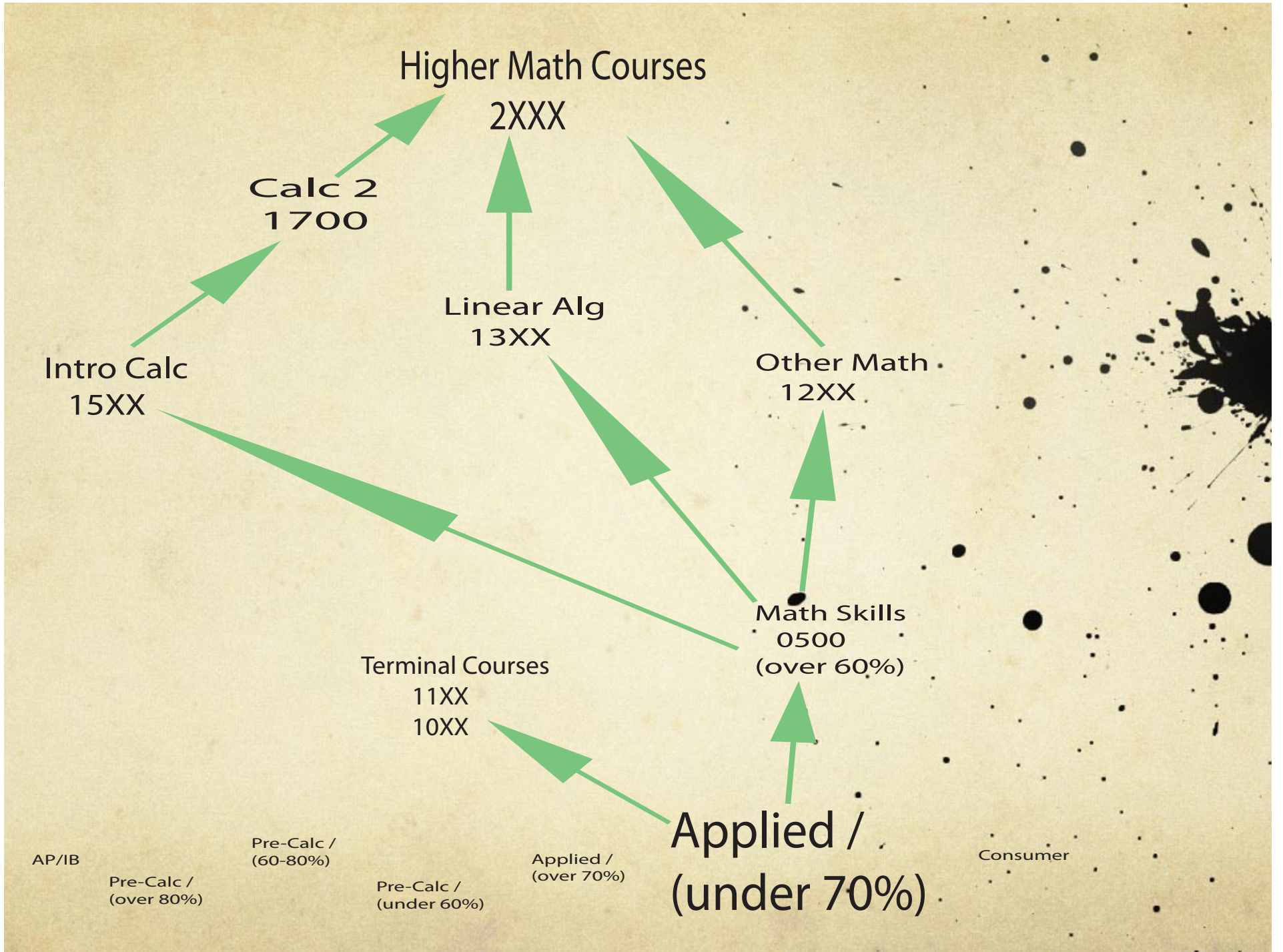
Which university math courses are required for my degree?

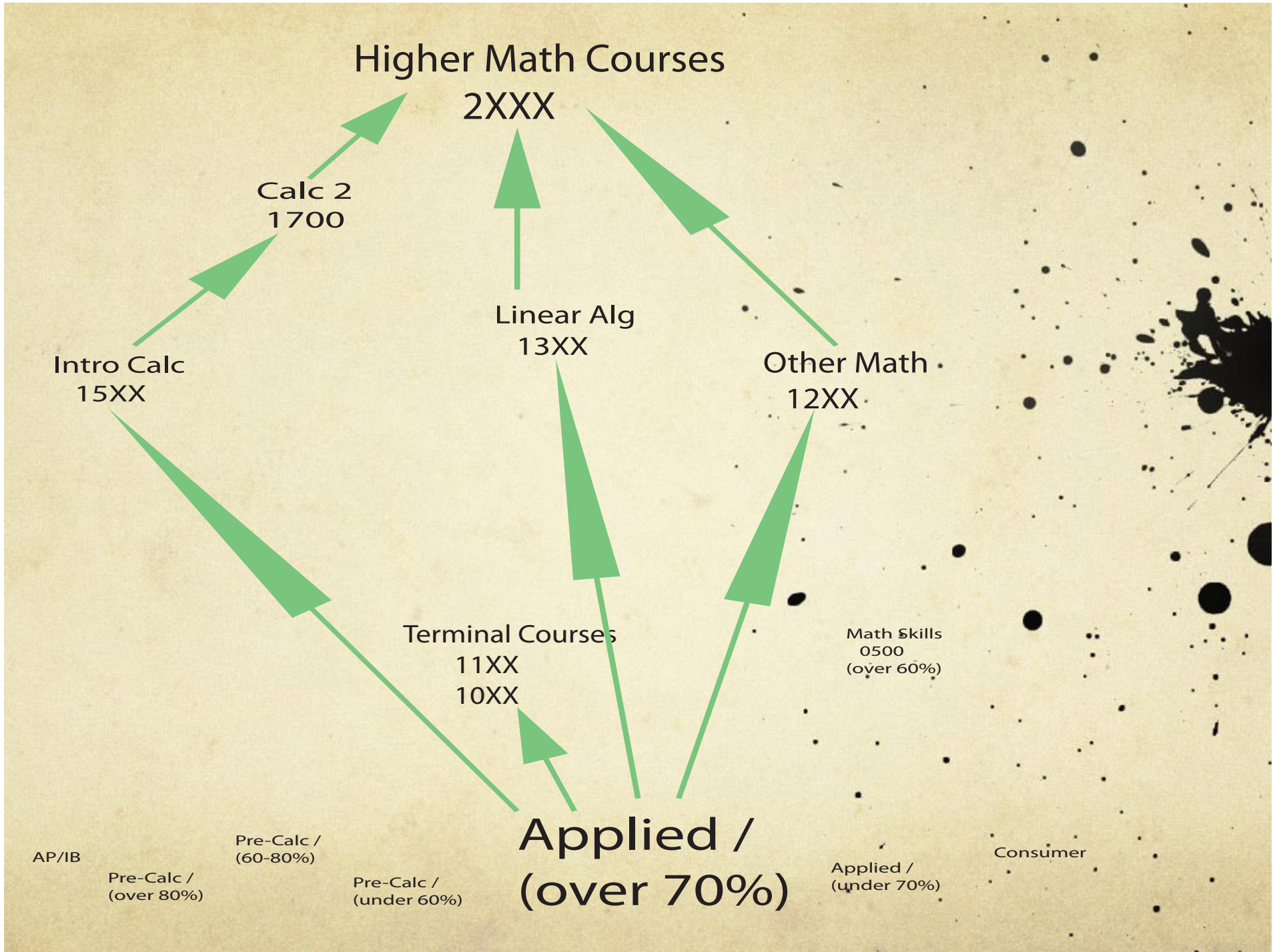
CHART II: Choosing your mathematics course by your intended program of study

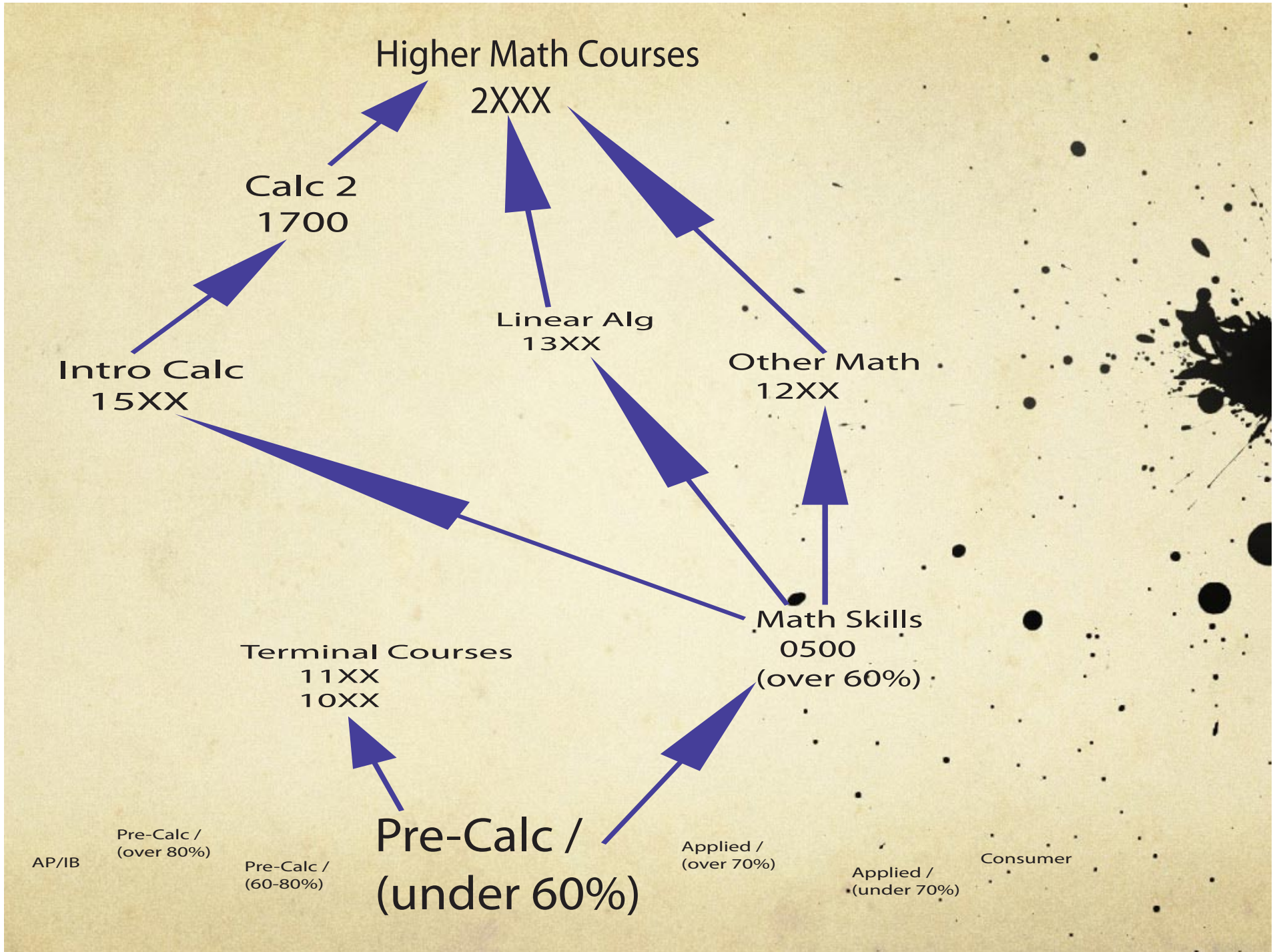
ABBREVIATIONS: In what follows, "MATH 13A0" means either MATH 1300 or MATH 1310; "MATH 15A0" means one of MATH 1500, MATH 1510, MATH 1520; and "MATH 17A0" means one of MATH 1700, MATH 1710, or MATH 1730.

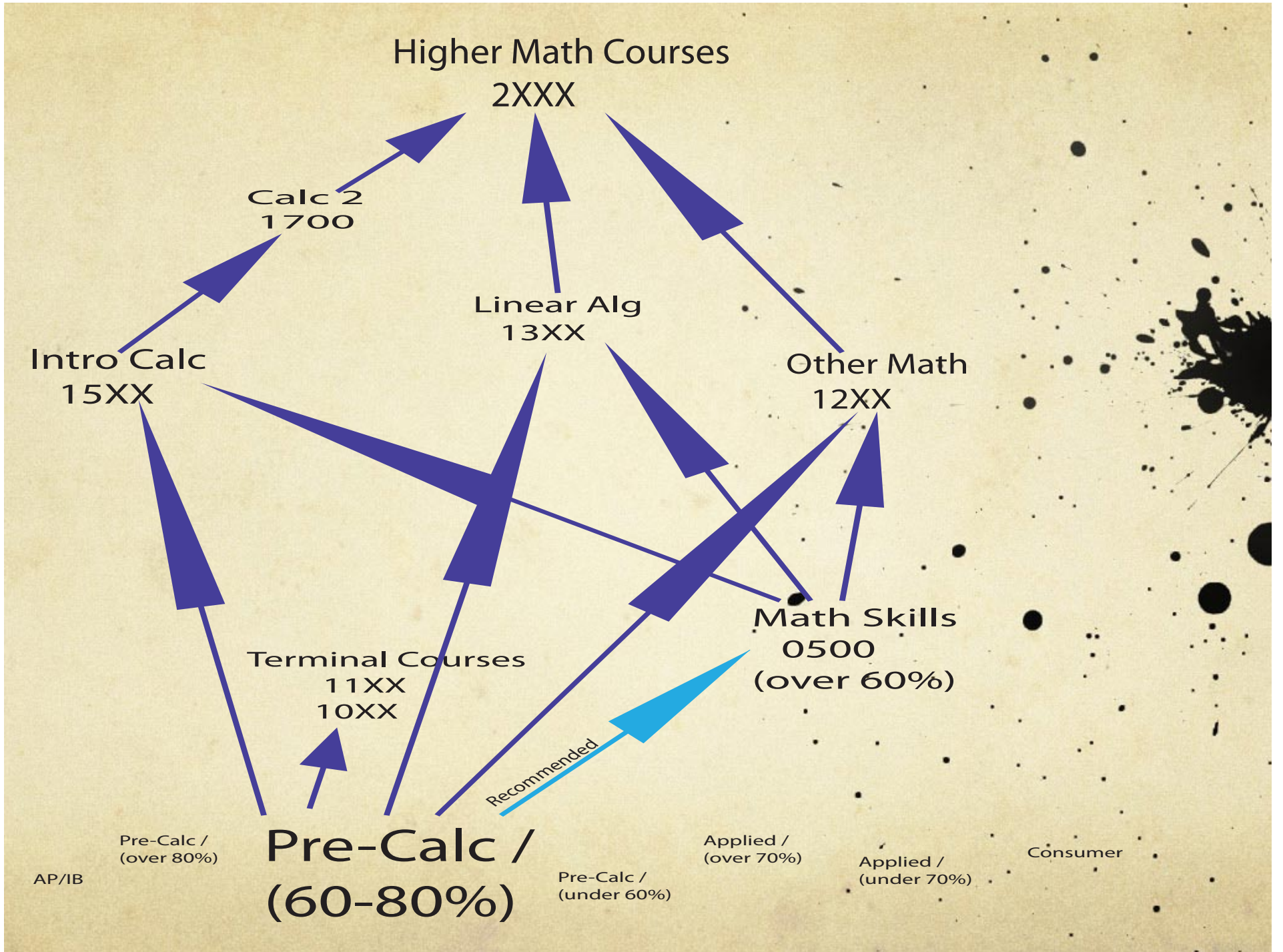
Intended program of study	Required courses for entry to program	Recommended courses (see Remark 1 on next page)
Faculty of Agricultural & Food Sciences	MATH 13A0 and MATH 15A0	MATH 1310 and MATH 1520
Faculty of Arts	3 credit hours from list of approved mathematics courses (see Section 4.1 of Calendar)	MATH 1010 or MATH 1190 (see note following Chart I)
Faculty of Arts (Honours Economics)	MATH 1500 together with either MATH 1300 or MATH 1700 (see Remark 3 on next page)	MATH 1300 and MATH 1500
Faculty of Engineering	MATH 1210, MATH 1510 and MATH 1710	MATH 1210, MATH 1510 and MATH 1710
Clayton H. Riddell Faculty of Environment, Earth and Resources (Geophysics Honours)	MATH 1210, MATH 15A0 and MATH 17A0, (see Remarks 3 and 4 on next page)	MATH 1210, MATH 1500 and MATH 1700
Faculty of Management (non Actuarial pattern)	MATH 13A0 and MATH 15A0 (see Remarks 3 and 4 on next page)	MATH 1310 and MATH 1520
Faculty of Management (Actuarial pattern)	MATH 13A0, MATH 15A0 and MATH 17A0 (see Remarks 3 and 4 on next page)	MATH 1300, MATH 1500 and MATH 1700
Faculty of Pharmacy	MATH 15A0	MATH 1500
Faculty of Science (Honours Biological Sciences)		MATH 1200, MATH 1300 or MATH 1500 (see Remark 1 on next page)
Faculty of Science (Biochemistry, Chemistry)	MATH 15A0, together with one of MATH 1200, MATH 13A0, MATH 17A0 (see Remarks 3 and 4 on next page)	MATH 1200, MATH 1300, MATH 1510 and MATH 1700
Faculty of Science (Computer Science)	MATH 13A0 and MATH 15A0 (see Remark 3 on next page)	MATH 1300 and MATH 1500
Faculty of Science (Mathematics major)	MATH 13A0, MATH 15A0 and MATH 17A0 (see Remarks 3 and 4 on next page)	MATH 1300, MATH 1500 and MATH 1700; perhaps also MATH 1200
Faculty of Science (Physics)	MATH 13A0, MATH 15A0 and MATH 17A0 (see Remarks 3 and 4 on next page)	MATH 1300, MATH 1500 and MATH 1700
Faculty of Science (Statistics major)	MATH 15A0 and MATH 17A0 (see Remarks 3 and 4 on next page)	MATH 1300, MATH 1500 and MATH 1700
Fine Arts	3 credit hours	MATH 1020

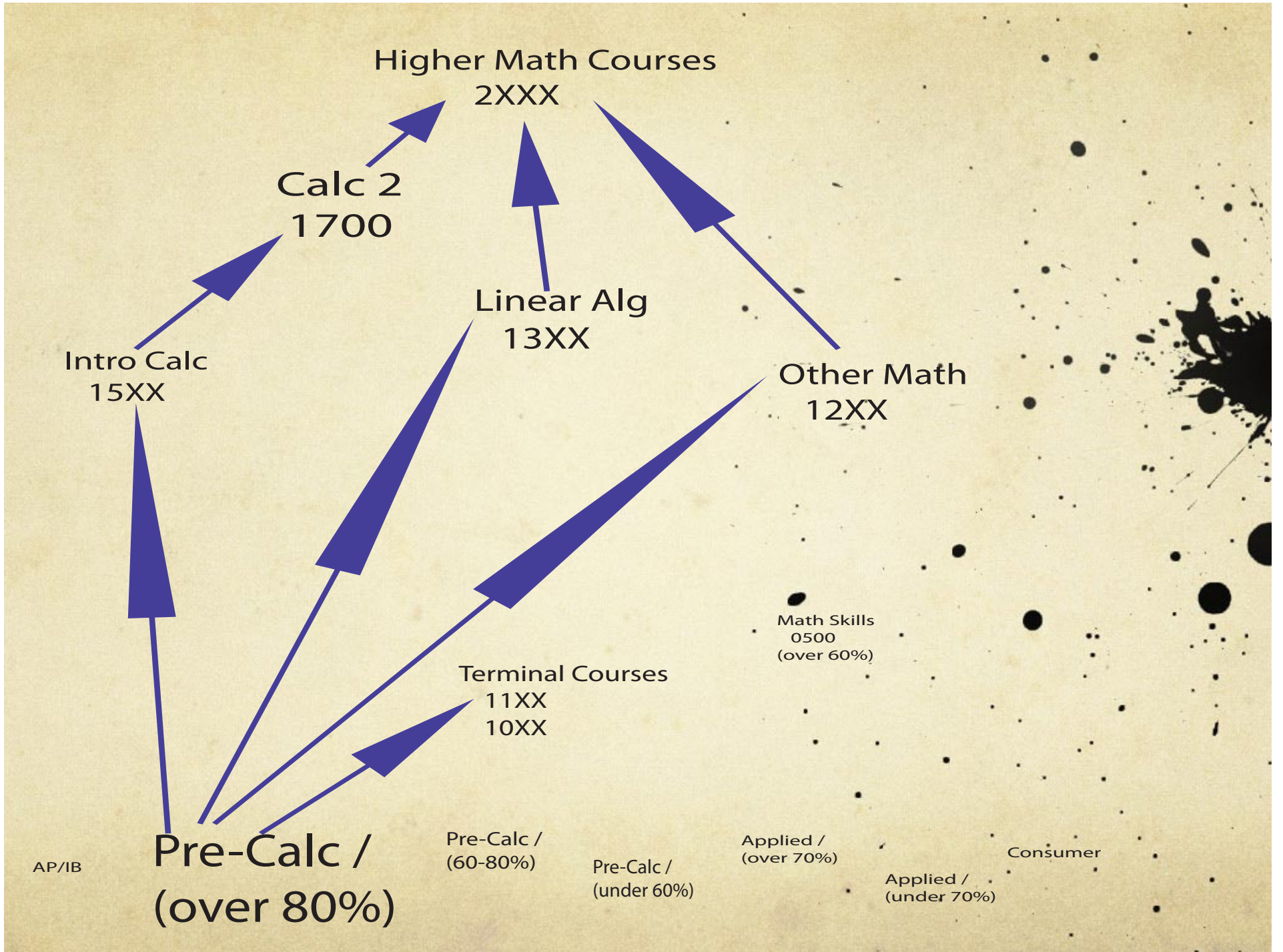












Higher Math Courses

2XXX

Calc 2
1700

Linear Alg
13XX

Intro Calc
15XX

Other Math
12XX

Math Skills
0500
(over 60%)

Terminal Courses
11XX
10XX

AP/IB

Pre-Calc /
(over 80%)

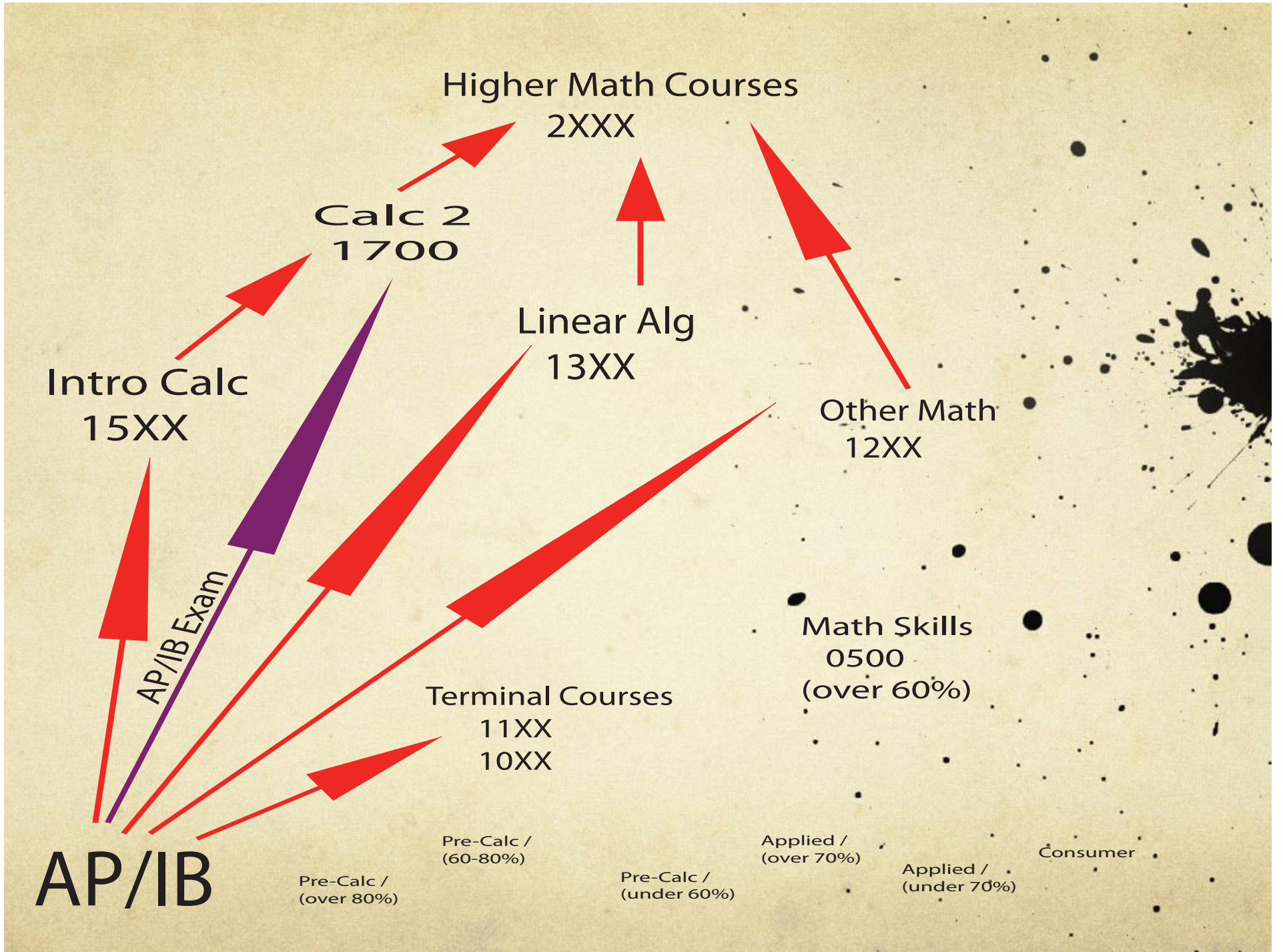
Pre-Calc /
(60-80%)

Pre-Calc /
(under 60%)

Applied /
(over 70%)

Applied /
(under 70%)

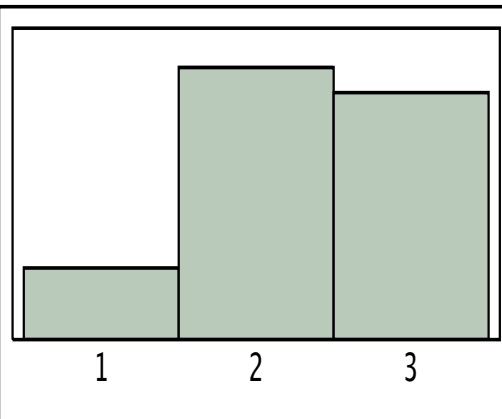
Consumer



How prepared do they feel once they are here?

- Survey of 245 students of MATH 1500 asked:
 - Q1: How useful do you feel that your **high school math courses** were in preparing you for MATH 1500?
 - Q17: What grade did you get on the midterm?

Q1



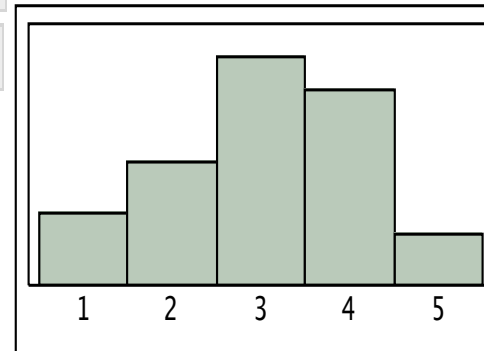
Frequencies

Level	Count	Prob
1	29	0.11837
2	113	0.46122
3	103	0.42041
Total	245	1.00000

N Missing 29

3 Levels

Q17



Frequencies

Level	Count	Prob
1	26	0.10612
2	45	0.18367
3	84	0.34286
4	72	0.29388
5	18	0.07347
Total	245	1.00000

N Missing 29

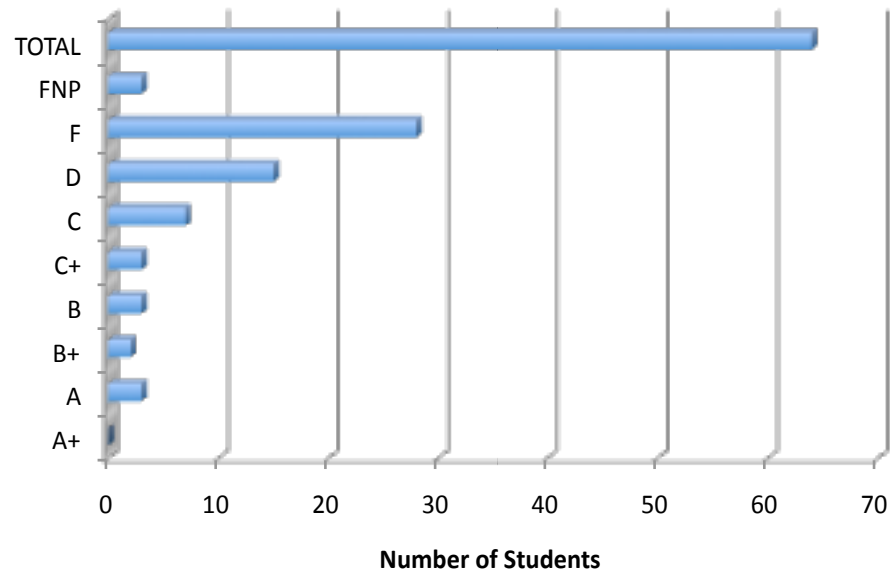
5 Levels

Pearson Chi-squared test: Significant evidence of a dependency

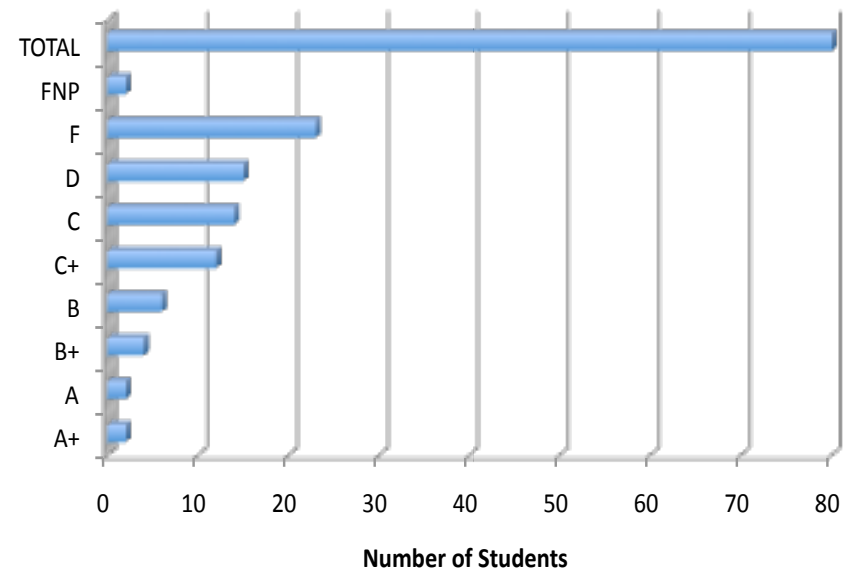
An effort to provide a “bridge” between high-school and university mathematics:

- In 1997 and 1998 the Department of Mathematics offered a pre-calculus course called “College Mathematics with Applications”, 136.100, taught by Dr. T. Kucera.
- The course was designed to offer “*upgrading, remedial, transitional, and developmental*” pre-calculus training.

1997 Grade Distribution



1998 Grade Distribution

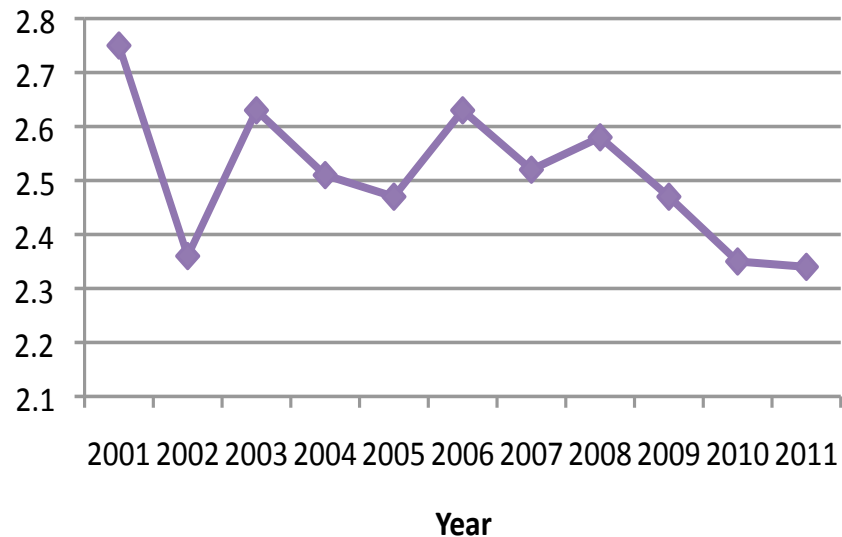


An effort to provide a “bridge” between high-school and university mathematics:

- Conclusions:
 - 1997 overall success (grade of C or better) rate was 19% (28% after VW).
 - 1998 overall success rate was 33% (50% after VW).
 - “In spite of coming into 136.100 with at least a 50% in Grade 12 mathematics, *most of these students were not in any way prepared to study Grade 12 mathematics.*”
 - “I do not think that 136.100 is viable without significant changes; these would be drastic enough to require a new course proposal.”

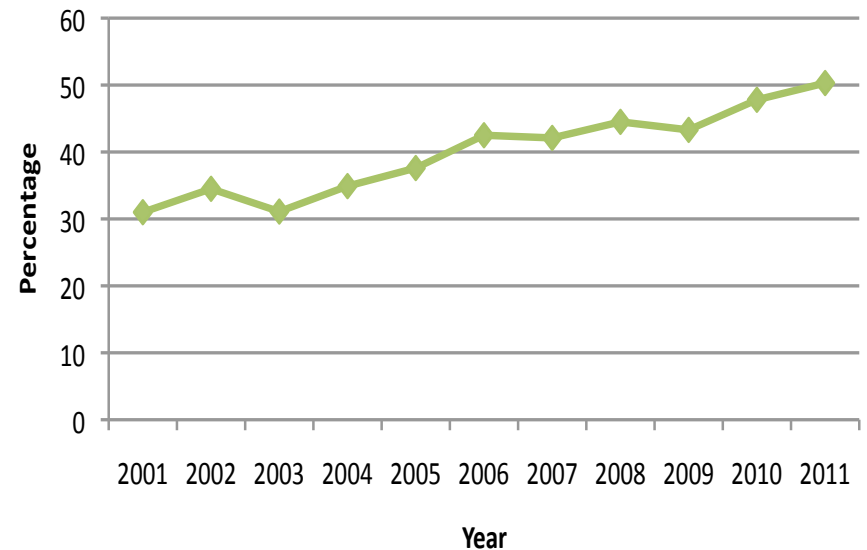
How well are students performing in first-year university mathematics courses?

MATH 1010 - GPA



Cox-Stuart Test for Trend:
No significant trend

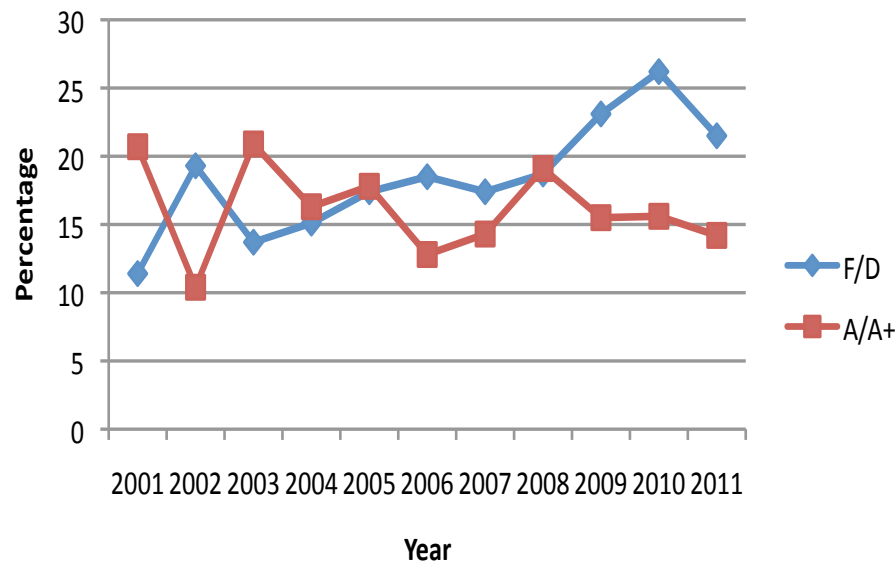
MATH 1010 - VW/F/D



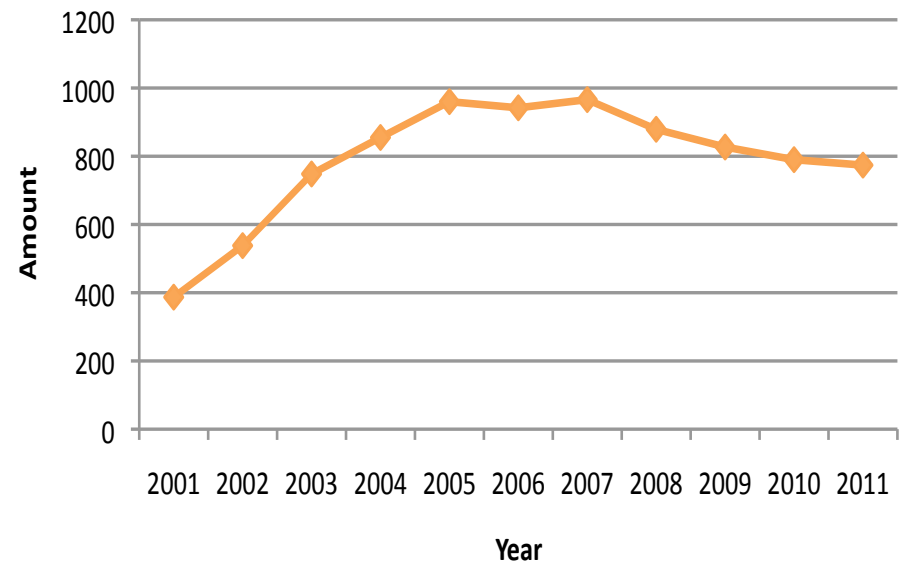
Cox-Stuart Test for Trend:
Significant increasing trend, $p < .05$

How well are students performing in first-year university mathematics courses?

MATH 1010 - Grades

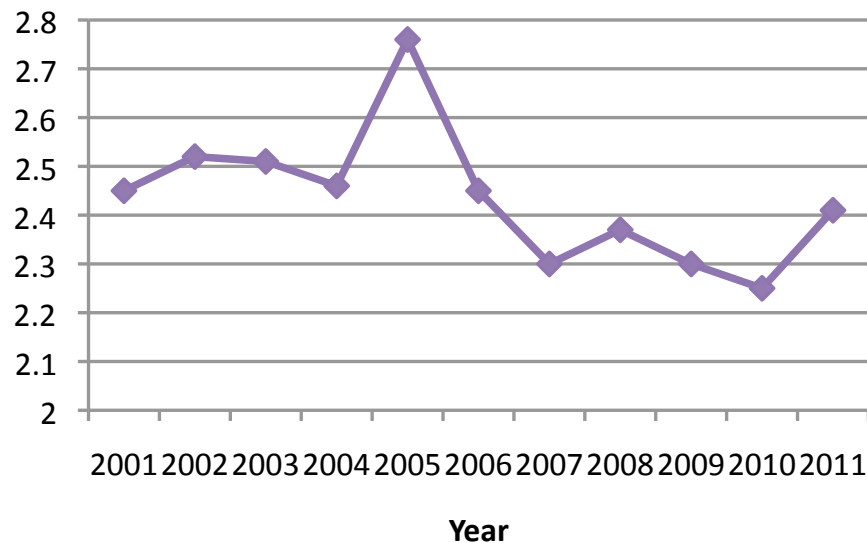


MATH 1010 - Enrollment



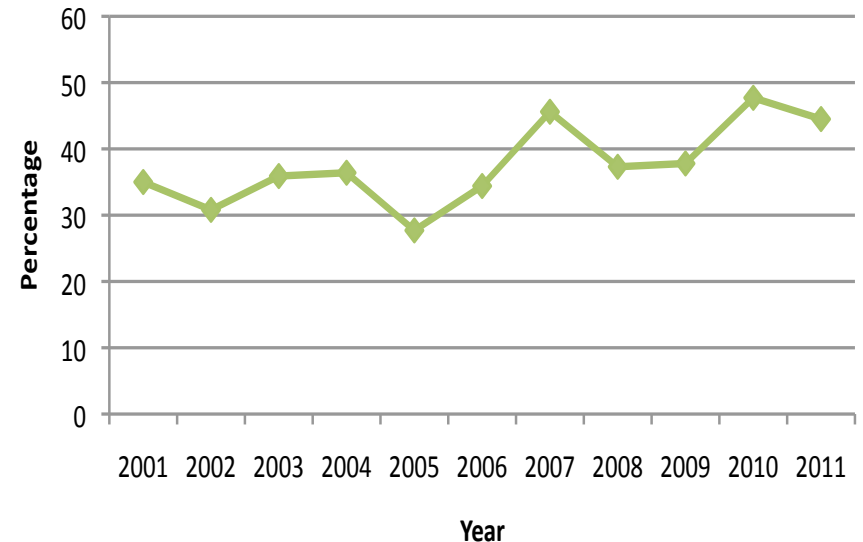
How well are students performing in first-year university mathematics courses?

MATH 1500 - GPA



Cox-Stuart Test for Trend:
Significant decreasing trend, $p < .05$

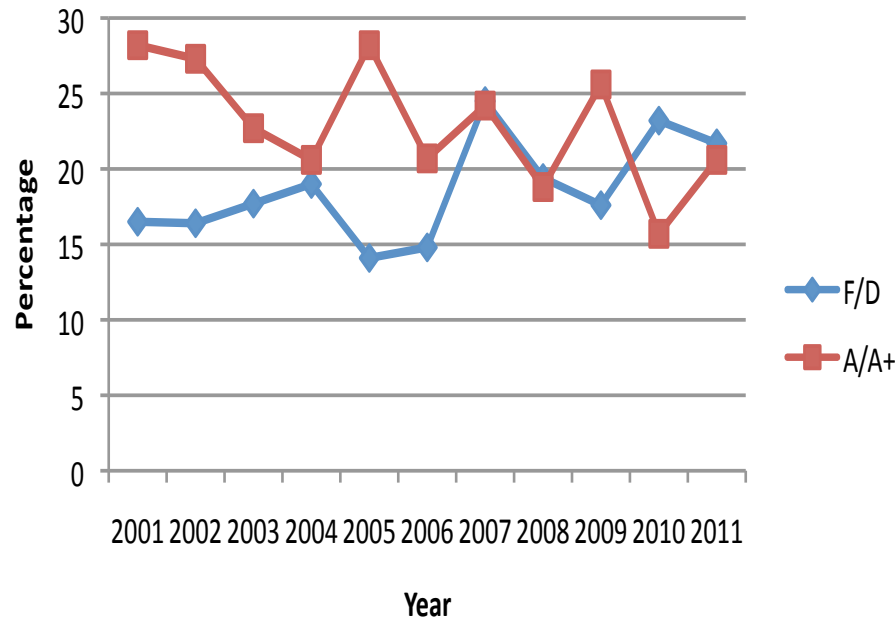
MATH 1500 - VW/F/D



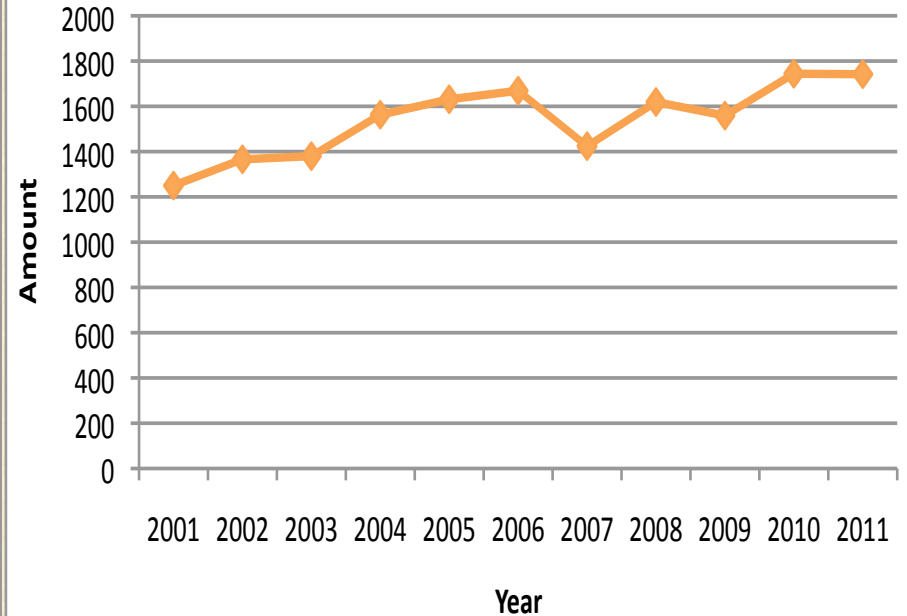
Cox-Stuart Test for Trend:
Significant increasing trend, $p < .05$

How well are students performing in first-year university mathematics courses?

MATH 1500 - Grades



MATH 1500 - Enrollment



How can we help students *prepare themselves?*

- Outreach activities
- Open communications with guidance counsellors
- Open access to such information (website)



How can we help schools *prepare their* *students?*

- Open communication with universities
- Link between K-12 and post-secondary curriculum
- Link between departments at the university level with the faculty of education



Further areas to explore:

- Quantitative:
 - How many take IB/AP and enroll in MATH 1500, and what are their grades?
 - Add demographic questions to survey (ie, to distinguish Manitoba high school students from international students).
 - Track students' grades from grade 12 - 1st year university.
- Qualitative:
 - Interviews with students in their last year of high school with follow-up during and after their first university mathematics course.

○ Further Readings:

- R. Clifton, W. Baldwin, and Y. Wei; “Course Structure, Engagement, and the Achievement of Students in First-Year Chemistry”, *Chemistry Education Research and Practice*
- C. Gewertz; “ACT Deems More Students College-Ready”, *Education Week* (Aug. 17, 2011)
- B. Phillips and B. Vandal; “Standards: A Critical Need for K-16 Collaboration”, *Education Week* (Nov. 1, 2011)
- J. Stiles; “From Competition to Transition: Sharing Resources to Ensure Student Success”, *Education Canada* (Vol. 51, Issue 4)
- R. Ward-Penny, S. Johnston-Wilder, and C. Lee; “Exit Interviews: Undergraduates Who Leave Mathematics Behind”, *For the Learning of Mathematics* (Vol. 31, Issue 2)
- M. Zwaagstra; “Math Instruction that Makes Sense”, *Frontier Centre for Public Policy* (Series No. 120)

○ Acknowledgements:

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Thank you!

