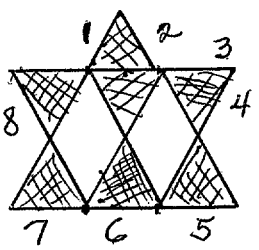
Inner School Test Part A answers pg 1

1. James Garfield
2. Etienne Pascal "Limaçon of Pascal"
3. $A = 5$
4. (1) Harriett (a)
   (2) Widman (e)
   (3) Oughtred (b)
   (4) Ralin (c)
   (5) Recorde (d)
5. 3 Observe pattern $1! = 1$
   $1! + 2! = 3$
   $1! + 2! + 3! = 9$
   $1! \ldots 4! = 33$
   $1! + \ldots 5! = 153$
   ⋮
6. Alphabetical Order
7. 20
8. 

   7 triangles; 9 edges
9. – 10 typed
11. Unwind stripe, S; $S = \frac{2\sqrt{25 + 64\pi^2}}{5}$
    ≈ 10.250 cm
12. 220
13. 12
14.

2	2	0
6	7	6
2	8	4

Interschool Test Answers pg. 2

25. $\sin x + \sin 2x + \sin 3x = 0$

$\sin x + 2\sin x \cos x + \sin(2x+x) = 0$

$\sin x + 2\sin x \cos x + 3\sin x \cos^2 x - \sin^3 x = 0$

$\sin x = 0$ $\quad 1 + 2\cos x + 3\cos^2 x - \sin^2 x = 0$

$1 + 2\cos x + 3\cos^2 x - 1 + \cos^2 x = 0$

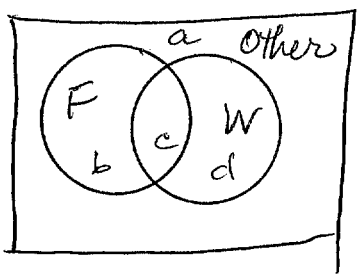
$2\cos x + 4\cos^2 x = 0$

$2\cos x (1 + 2\cos x) = 0$

$\cos x = 0$ $\quad \cos x = -1/2$

$\{0, \pi, \pi/2, 3\pi/2, 2\pi/3, 4\pi/3\}$

26. 20% or $\boxed{.2}$



F = flooded
W = Weak battery

$P(F) = .7 = b + c$
$P(W) = .3 = c + d$
$P(O) = .2 = a$

$P(F \wedge W) = c$
$P(F \cup W) = .8 = b + c + d$

$b = .5$
$d = .1$
So $c = .2$

27. 55%

ch.7 ch.11

Distribution $[.6 \quad .4]$ Transition

	c7	c11
c7	.7	.3
c11	.2	.8

$[.5 \quad .5][T] = [.45, .55]$

28. Each should choose Philadelphia

Payoff matrix Delta

	P	M	SL
P	50,000	200,000	2,000,000
M	25,000	75,000	0
SL	−50,000	0	−100,000

(United)

Inner School

Tiebreaker

$I=6 \quad S=1$
$D=3 \quad T=2$
$O=7$

$\frac{6}{37} = .162162\ldots$ Tiebreaker

Realizing that $\frac{SII}{999} = .SITSIT\ldots$

Consider reducing 999 by a factor that would become a 2-digit number. $27 * 37 = 999$ Choose 37

Now test single digit numerators

~~Then~~ $\frac{I}{37} = .SITSIT\ldots$

Inner School Test Part A: Answers & Selected solutions

(Numbers not listed here have hand-written scanned solutions.)

9. Wherever the function f(x) intersects the line y = x, it also intersects its inverse. Following this logic through gives us the following solutions **(0,0), (-2,-2), (1,1).**

10. Answer: 741
abc 100a + 10b + c
a + b + c = 12
a - b = b - c
a > b + c
a + b + c = 12
-a + 2b -/+ c = 0/3b = 12
b = 4
a + c = 8
8 - c > 4 + c
4 > 2c
c < 2
abc is odd numbered so the digit "c" must be odd.
Hence c = 1, a = 7 and b = 4 NUMBER 741

15. 16

16. 498,500

17. 1.8 (velocity of the bird)

18. 15

19. 36

20. $\frac{2}{195}$

21. 1760 yds

22.

23. π

24. Al- Khowarizmi

29. 2 at 8 points and 7 at 12 points

30.
$$x = \frac{1}{2}\sqrt{2-\sqrt{2}}\ x' - \frac{1}{2}\sqrt{2+\sqrt{2}}\ y'$$
$$y = \frac{1}{2}\sqrt{2+\sqrt{2}}\ x' + \frac{1}{2}\sqrt{2-\sqrt{2}}\ y'$$

31. $33\frac{1}{3}\min$ *or* $\frac{5}{9}hr$

32. Alf and Bert are guilty. If Bert is innocent, then Cash is innocent and Alf is guilty; but Alf never works alone. Therefore, no one is guilty. Therefore, Bert cannot be innocent; he must be guilty. If Bert is guilty, then Cash is innocent and Alf is guilty.

33. 8, 16

Player Number	Weight	Cumulative Average
1	x	x
2	x+2	x+1
3	(x+1)+3	x+2
4	(x+2)+4	x+3
5	(x+3)+5	x+4

Fifth player weighs 8 more kilograms than the first!
When difference is 2 lbs ->5th player weighs 16 more kilograms.

34. 7

Let n be the last number on the board. The largest possible average is obtained of the digit 1 is erased; the average is then
(2+3+...+n)/(n-1)=((n+1)n/2-1)(n-1)=(n+2)/2
The smallest average possible is obtained when n is erased the average then:
n(n-1)/2(n-1) = n/2 1+2+.....n-1/n-1
Thus
n/2 <= 35 7/17 <= n+2/2
n <= 70 14/17 <= n+2
68 14/17 <= n <= 70 14/17
Therefore
n = 69 pr 70. Since 35 7/17 is the average of (n-1) integers (35 7/17)(n-1) must be an integer and n is 69.
If x is the number erased.
1/2(69)(70)-x/68 = 35 7/17
69 ??? 35 - x = 35 (7/17) 68
x = 7

35. $12\pi\frac{m^2}{\text{sec}}$

A = pi r^2 r = x tan 30 degrees = x / 3^.5
= pi x^2 / 3 dx / dt = 3 m/s

dA / dt = dA / dx * dx / dt
= (2pi * x / 3) * 3m/s
= 2pi * x m/s at x = 6 dA/dt = 2 pi (6) m^2/s
= 12 pi m^2/s

36. $215.54 million

P(5) = 30 + 6 log(5 + 2)/log 2
= 46.84 million dollars
80 = 30 + 6 log2 (x + 2)
50 / 6 = log2 (x + 2)
2^(50/6) = (x + 2)
x = 320.54 million dollars.
therefore: increase in spending = 320.54 - 5 = 215.54 million

37. c_1 = 81 km/hr c_2 = 135 km/hr

Let x = rate of car 1 (m/s)
Let y = rate of car 2 (m/s)
1800m = 30x+30y
1800-30x = 30y
7200-120x = 120y
1800 + 120x = 120y
Solve for Car 1:
7200-120x = 1800+120x
5400 = 240x
x = 22.5 m/s
Convert to km/hr
x = 22.5m/sec *60sec/min*60min/hr = 81 km/hr
1000 m/km
Solve for Car 2:
Substitute x = 22.5 m/s 1800+120x = 120y
y = 37.5 m/s
Convert to km/hr
x =37.5m/sec *60sec/min*60min/hr = 135 km/hr
1000 m/km

38. 21.998
0.5*b*h = 11
b = length AC
b*h = 22 h = length CB
b = 22/h c = length AB
c^2 = b^2 + h^2
100 = b^2 + h^2
100 = (22/h)^2 + h^2
100 = 22^2/h^2 +h^2
100h^2 = 22^2 + h^4
h^4-100h^2+284 = 0
To solve, use quadratic formula:
$h^2 = \frac{100+[(100)^2-4(484)]}{2} = 9.74$

$$h^2 = \frac{100 - [(100)^2 - 4(484)]}{2} = 2.258$$

Since b = 22/h, then b = 9.74 <----- Therefore, use h= 2.258

39. 76 km/hr

100 - 3t = 88
100 - 88 = 3t

t = 12/3
t = 4 km/h per person

When six persons are on board, the van travels at
100 - 6t = 100 - 6(4) = 76 km/h

40. 15.1 sec

t0 = 2s for speeder
ds = 40 m/s to + 40 m/s t
dp = 3.0 m/s^2 (t)^2
ds = dp
40 (2) + 40t = 3.0t^2
3.0t^2 - 40t - 80 = 0
t = 40 +/- (1600 + 4(3)(80))^.5 = 15.1, -1.77 time always (t)
It will take the police 15.1 s to catch the speeder.