

## X9 REGISTRY FOR CHECK IMAGE TESTS

CONTROLLING SPECIFICATION: ANS X9.100-40 Parts 1 & 2

**Image Test Name:** IBM Missing Corners  
**Image Test Number:** 019.00  
**Image Test Version:** 00  
**Image Test Status:** A

*Where:*

*A = Active (approved for use)*

*W = Withdrawn (not for use)*

*S = Superseded (not for use -  
replaced by specified test)*

1	Applicant Information	
1.1	Organization Name:	IBM Corporation
1.2	Organization Address:	8501 IBM Drive MG83/202-3 Charlotte, NC 28262
1.3	Organization Web Site URL:	<a href="http://www.ibm.com">http://www.ibm.com</a>

Approved by: X9 RMG for Check Image Tests March 30, 2007

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<b>2</b>	<b>Image Test Description</b>	
<b>2.1</b>	<b>Image Test Name:</b>	IBM Missing Corners
<b>2.2</b>	<b>Image Test XML Name:</b>	missingcorners
<b>2.3</b>	<b>Image Test Definition:</b>	A metric used to measure the size of any corner data that may be missing from any of the four corners of an image
<b>2.4</b>	<b>Image Test Applicability:</b> Check all that apply.	<input checked="" type="checkbox"/> <i>Front Image</i> <input checked="" type="checkbox"/> <i>Rear Image</i> <input checked="" type="checkbox"/> <i>B/W Image</i> <input checked="" type="checkbox"/> <i>Grayscale Image</i> <input type="checkbox"/> <i>Color Image</i>
<b>2.5</b>	<b>Intended Use:</b> Intended business use/ application, business context, and business impact when test fails.	This metric will report a failure if the measured amount of missing corner data from <u>any</u> of the four corners of an image exceeds a predefined threshold.
<b>2.6</b>	<b>Possible Causes for Condition Being Tested:</b>	This test will execute whenever an image is processed. This metric will be generated for every image. Failures can occur if a problem occurs during the image scanning process. A failure may also occur if the document is folded when scanned or the scanned document contains portions that may be torn off of the document.
<b>2.7</b>	<b>Additional (or Repetitive) Information:</b>	<p>This check is performed on every image.</p> <p>An example of the XML output generated by IQA for this metric is shown below:</p> <pre>&lt;missingcorners&gt;   &lt;inches corner='upperleft'&gt;0.00&lt;/inches&gt;   &lt;inches corner='upperright'&gt;0.00&lt;/inches&gt;   &lt;inches corner='lowerleft'&gt;0.00&lt;/inches&gt;   &lt;inches corner='lowerright'&gt;0.00&lt;/inches&gt;   &lt;score&gt;10.0&lt;/score&gt; &lt;/missingcorners&gt;</pre> <p>The parameters associated with this metric are used to compare the measured missing corner size (in square inches) to a specific threshold. Based on the user's setting, the score for Missing Corners is based on the lowest of the four separate corner scores. Details on the way in which this measurement is derived are provided in section 2.10.</p>

**2.8 Test Results Reported**

*A test result is the outcome realized from executing an image test. The outcome will typically be the observed or measured value of some attribute pertaining to the image being tested.*

*Any dependency of a test result on an image side (front or rear), image rendition (B/W, Gray, Color), or other condition shall be fully defined in the Additional Information section.*

*Data types allowed are as defined in ANS X9.100-180-2006, but are typically alphabetic, numeric, alphanumeric, signed numeric (using “+” and “-“ to denote sign), etc.*

**2.8.1 First Image Test Result**

**Test Result Name: Upper Left Corner Size**

Test Result XML Name:	Data Type:	Data Units:	Data Range:	Margin of Error (in Data Units) (Where Applicable):
inches corner='upperleft'	Numeric	Hundredths of square inch		Rounding error to .005 square inch

<b>Description:</b>	This value provides the size in square inches of the largest square that can fit into any missing corner that is located at the top left of an image under test.
<b>Formula and/ or Algorithm:</b>	<p>The corner is examined for any black background (for a black/white image) or for any background that is darker than a threshold value for grayscale. If any area is located, we fit the largest rectangle within the corner to determine its size. The score reported for the entire image is the lowest of the four corner scores.</p> <p>This value is the size of the largest rectangle (in hundredths of square inches) that can fit into the “missing” corner.</p> <p>The scoring of this metric relies on the measured value and :</p> <ul style="list-style-type: none"> <li>• Upper Left Corner Missing LastGood</li> <li>• Upper Left Corner Missing FirstBad</li> <li>• Upper Left Corner Missing Exponent</li> </ul> <p>These values used for the test are user-settable. When the specific score for this corner is generated, it is used internally. The reported image “score” is the lowest value detected on any of the four image corners. Information on how the scoring is generated by IQA is shown in section 2.10.</p>
<b>Additional Information:</b>	This test will provide reliable results <i>only</i> if the item is scanned with a black background. The analysis software will not be able to determine if a missing corner exists when the scan background is very close in darkness to the document background.

**2.8.2 Second Image Test Result**

**Test Result Name: Upper Right Corner Size**

Test Result XML Name:	Data Type:	Data Units:	Data Range:	Margin of Error (in Data Units) (Where Applicable):
inches corner='upperright'	Numeric	Hundredths of square inch		Rounding error to .005 square inch

<b>Description:</b>	This value provides the size in square inches of the largest square that can fit into any missing corner that is located at the top right of an image under test.
<b>Formula and/ or Algorithm:</b>	<p>The corner is examined for any black background (for a black/white image) or for any background that is darker than a threshold value for grayscale. If any area is located, we fit the largest rectangle within the corner to determine its size.</p> <p>This value is the size of the largest rectangle (in hundredths of square inches) that can fit into the “missing” corner.</p> <p>The scoring of this metric relies on the measured value and :</p> <ul style="list-style-type: none"> <li>• Upper Right Corner Missing LastGood</li> <li>• Upper Right Corner Missing FirstBad</li> <li>• Upper Right Corner Missing Exponent</li> </ul> <p>These values used for the test are user-settable. When the specific score for this corner is generated, it is used internally. The reported image “score” is the lowest value detected on any of the four image corners. Information on how the scoring is generated by IQA is shown in section 2.10.</p>
<b>Additional Information:</b>	This test will provide reliable results <i>only</i> if the item is scanned with a black background. The analysis software will not be able to determine if a missing corner exists when the scan background is very close in darkness to the document background

**2.8.3 Third Image Test Result**

**Test Result Name: Lower Left Corner Size**

Test Result XML Name:	Data Type:	Data Units:	Data Range:	Margin of Error (in Data Units) (Where Applicable):
inches corner='lowerleft'	Numeric	Hundredths of square inch		Rounding error to .005 inch

**Description:** This value provides the size in square inches of the largest square that can fit into any missing corner that is located at the lower left corner of an image under test.

**Formula and/ or Algorithm:**

The corner is examined for any black background (for a black/white image) or for any background that is darker than a threshold value for grayscale. If any area is located, we fit the largest rectangle within the corner to determine its size. This value is the size of the largest rectangle (in hundredths of square inches) that can fit into the “missing” corner.

The scoring of this metric relies on the measured value and :

- Lower left Corner Missing LastGood
- Lower left Corner Missing FirstBad
- Lower left Corner Missing Exponent

These values used for the test are user-settable. When the specific score for this corner is generated, it is used internally. The reported image “score” is the lowest value detected on any of the four image corners. Information on how the scoring is generated by IQA is shown in section 2.10.

**Additional Information:** This test will provide reliable results *only* if the item is scanned with a black background. The analysis software will not be able to determine if a missing corner exists when the scan background is very close in darkness to the document background

**2.8.4 Fourth Image Test Result**

**Test Result Long Name: Lower Right Corner Size**

Test Result XML Name:	Data Type:	Data Units:	Data Range:	Margin of Error (in Data Units) (Where Applicable):
inches corner='lowerright'	Numeric	Hundredths of square inch		Rounding error to .005 inch

<b>Description:</b>	This value provides the size in square inches of the largest square that can fit into any missing corner that is located at the lower right corner of an image under test.
<b>Formula and/ or Algorithm:</b>	<p>The corner is examined for any black background (for a black/white image) or for any background that is darker than a threshold value for grayscale. If any area is located, we fit the largest rectangle within the corner to determine its size.</p> <p>This value is the size of the largest rectangle (in hundredths of square inches) that can fit into the “missing” corner.</p> <p>The scoring of this metric relies on the measured value and :</p> <ul style="list-style-type: none"> <li>• Lower right Corner Missing LastGood</li> <li>• Lower right Corner Missing FirstBad</li> <li>• Lower right Corner Missing Exponent</li> </ul> <p>These values used for the test are user-settable. When the specific score for this corner is generated, it is used internally. The reported image “score” is the lowest value detected on any of the four image corners. Information on how the scoring is generated by IQA is shown in section 2.10.</p>
<b>Additional Information:</b>	This test will provide reliable results <i>only</i> if the item is scanned with a black background. The analysis software will not be able to determine if a missing corner exists when the scan background is very close in darkness to the document background

**2.8.5 Fifth Image Test Result**

**Test Result Name: Missing Corner Score**

<b>Test Result XML Name:</b>	<b>Data Type:</b>	<b>Data Units:</b>	<b>Data Range:</b>	<b>Margin of Error (in Data Units) (Where Applicable):</b>
score	Numeric	N/A	0-1000	
<b>Description:</b>	This value provides the image's "score" for the missing corners test. This value is the lowest score that is derived from the scores of all four of the missing corner tests.			
<b>Formula and/ or Algorithm:</b>	This value is the lowest "score" that was detected for any of the four corners that were examined for this test. This score is based on a scale of 0-1000 where '0' is the lowest score possible and 1000 is the highest score possible. There are no units for this metric.			
<b>Additional Information:</b>				



<b>2.9</b>	<p><b>Test Parameters Reported</b></p> <p><i>Examples of image test parameters are threshold values used to compute a pass/fail image test flag condition, and constant values used in a formula or algorithm to compute an image test result.</i></p> <p><i>Any dependency of a test parameter on an image side (front or rear), image rendition (B/W, Gray, Color), or other condition shall be fully defined in the Additional Information section.</i></p> <p><i>Any dependency of recommended values on an image side (front or rear), image rendition (B/W, Gray, Color), or other condition shall be fully defined in the Recommended Values section.</i></p> <p><i>Data types allowed are as defined in ANS X9.100-180-2006, but are typically alphabetic, numeric, alphanumeric, signed numeric (using “+” and “-” to denote sign), etc.</i></p>
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<b>2.9.1 First Test Parameter</b>				
<b>Test Parameter Name: Test Threshold</b>				
<b>Test Parameter XML Name:</b>	<b>Data Type:</b>	<b>Data Units:</b>	<b>Data Range:</b>	<b>Recommended Value(s) (Where Applicable):</b>
	Numeric	None	0-1000	700 (default)
<b>Description:</b>	This reported parameter is the threshold used to make the pass/fail decision. This value is settable by the user. If the calculated “score” is greater than or equal to the threshold, the test passes. If the “score” is lower than the threshold, the test fails.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution. The value may be set to any floating point value between 0 and 10.0 by the user. In reporting this parameter, the value is multiplied by 100 and converted to an integer.			

### 2.9.2 Second Test Parameter

**Test Parameter Name: Upper Left Corner Missing Last Good**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the Last Good value utilized in the evaluation (" <i>scoring</i> ") of the size of the square that can fit into a torn upper left corner.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

### 2.9.3 Third Test Parameter

**Test Parameter Name: Upper Left Corner Missing FirstBad**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the First Bad value utilized in the evaluation (" <i>scoring</i> ") of the size of the square that can fit into a torn upper left corner.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

#### 2.9.4 Fourth Test Parameter

**Test Parameter Name: Upper Left Corner Missing Exponent**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric			
<b>Description:</b>	This is the value that controls the shape of the “line” between the <b>Upper Left Corner Missing First Bad</b> and <b>Upper Left Corner Missing Last Good</b> parameters. The IBM IQA product stores this value internally as a floating point number. In reporting this parameter, the value is multiplied by 10 and converted to an integer. See section 2.10 for further descriptions.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution. The value may be set to any floating point value between 0 and 10.0 by the user. In reporting the value for this parameter, the value used internally is multiplied by 10 and converted to an integer.			

#### 2.9.5 Fifth Test Parameter

**Test Parameter Name: Upper Right Corner Missing Last Good**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the Last Good value utilized in the evaluation (“ <i>scoring</i> ”) of the size of the square that can fit into a torn upper right corner.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

### 2.9.6 Sixth Test Parameter

**Test Parameter Name: Upper Right Corner Missing FirstBad**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the First Bad value utilized in the evaluation (“scoring”) of the size of the square that can fit into a torn upper right corner.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

### 2.9.7 Seventh Test Parameter

**Test Parameter Name: Upper Right Corner Missing Exponent**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric			
<b>Description:</b>	This is the value that controls the shape of the “line” between the <b>Upper Right Corner Missing First Bad</b> and <b>Upper Right Corner Missing Last Good</b> parameters. The IBM IQA product stores this value internally as a floating point number. In reporting this parameter, the value is multiplied by 10 and converted to an integer. See section 2.10 for further descriptions.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution. The value may be set to any floating point value between 0 and 10.0 by the user. In reporting the value for this parameter, the value used internally is multiplied by 10 and converted to an integer.			

**2.9.8 Eighth Test Parameter****Test Parameter Name: Lower Left Corner Missing Last Good**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the Last Good value utilized in the evaluation (“ <i>scoring</i> ”) of the size of the square that can fit into a torn lower left corner.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

**2.9.9 Ninth Test Parameter****Test Parameter Name: Lower Left Corner Missing First Bad**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the First Bad value utilized in the evaluation (“ <i>scoring</i> ”) of the size of the square that can fit into a torn lower left corner.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

### 2.9.10 Tenth Test Parameter

**Test Parameter Name: Lower Left Corner Missing Exponent**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		

**Description:** This is the value that controls the shape of the “line” between the **Lower Left Corner Missing First Bad** and **Lower Left Corner Missing Last Good** parameters. The IBM IQA product stores this value internally as a floating point number. In reporting this parameter, the value is multiplied by 10 and converted to an integer. See section 2.10 for further descriptions.

**Additional Information:** This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution. The value may be set to any floating point value between 0 and 10.0 by the user. In reporting the value for this parameter, the value used internally is multiplied by 10 and converted to an integer.

### 2.9.11 Eleventh Test Parameter

**Test Parameter Name: Lower Right Corner Missing Last Good**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		

**Description:** This is the Last Good value utilized in the evaluation (“scoring”) of the size of the square that can fit into a torn lower right corner of the image.

**Additional Information:** This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.

### 2.9.12 Twelfth Test Parameter

**Test Parameter Name: Lower Right Corner Missing First Bad**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the First Bad value utilized in the evaluation (“scoring”) of the size of the square that can fit into a torn lower right corner.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution.			

### 2.9.13 Thirteenth Test Parameter

**Test Parameter Name: Lower Right Corner Missing Exponent**

Test Parameter XML Name:	Data Type:	Data Units:	Data Range:	Recommended Value(s) (Where Applicable):
	Numeric	Hundredths of square inches		
<b>Description:</b>	This is the value that controls the shape of the “line” between the <b>Lower Right Corner Missing First Bad</b> and <b>Lower Right Corner Missing Last Good</b> parameters. The IBM IQA product stores this value internally as a floating point number. In reporting this parameter, the value is multiplied by 10 and converted to an integer. See section 2.10 for further descriptions.			
<b>Additional Information:</b>	This value corresponds to the value that the user sets in the IBM IQA profile that is active for this test execution. The value may be set to any floating point value between 0 and 10.0 by the user. In reporting the value for this parameter, the value used internally is multiplied by 10 and converted to an integer.			

2.10

**Image Test Flag  
Pass/Fail Criteria:**

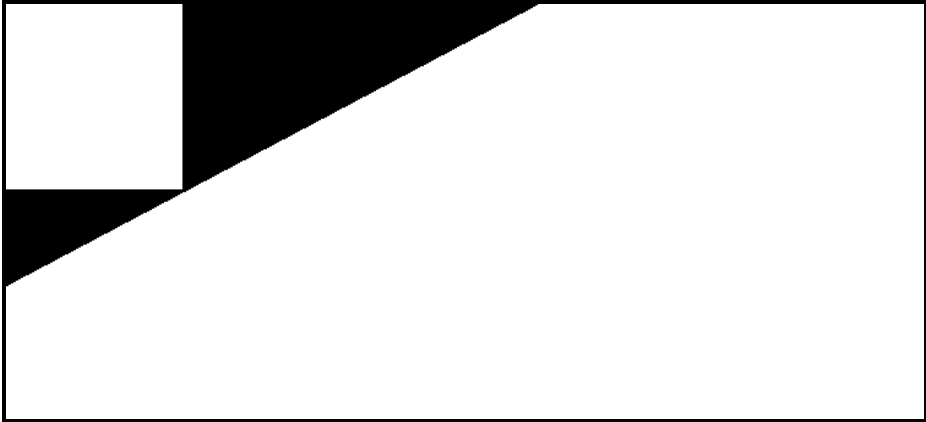
*The Image Test Flag (see ANS X9.100-40-1-2006 for details) will convey one of the following four test conditions:*

- *Condition not tested*
- *Condition tested and result = fail*
- *Condition tested and result = pass*
- *Condition tested and result=indeterminate*

The software will *always* report this result for a valid image. There will be two possible results:

- *Condition tested and result = fail*  
This test will **fail** when any of the corner's being checked yield a "torn" or "missing" square larger than a predefined threshold.
- *Condition tested and result = pass*  
This test will **pass** when all of the corner's being checked yield a "torn" or "missing" square less than a predefined threshold.

The chart below shows the way in which the test score is derived.

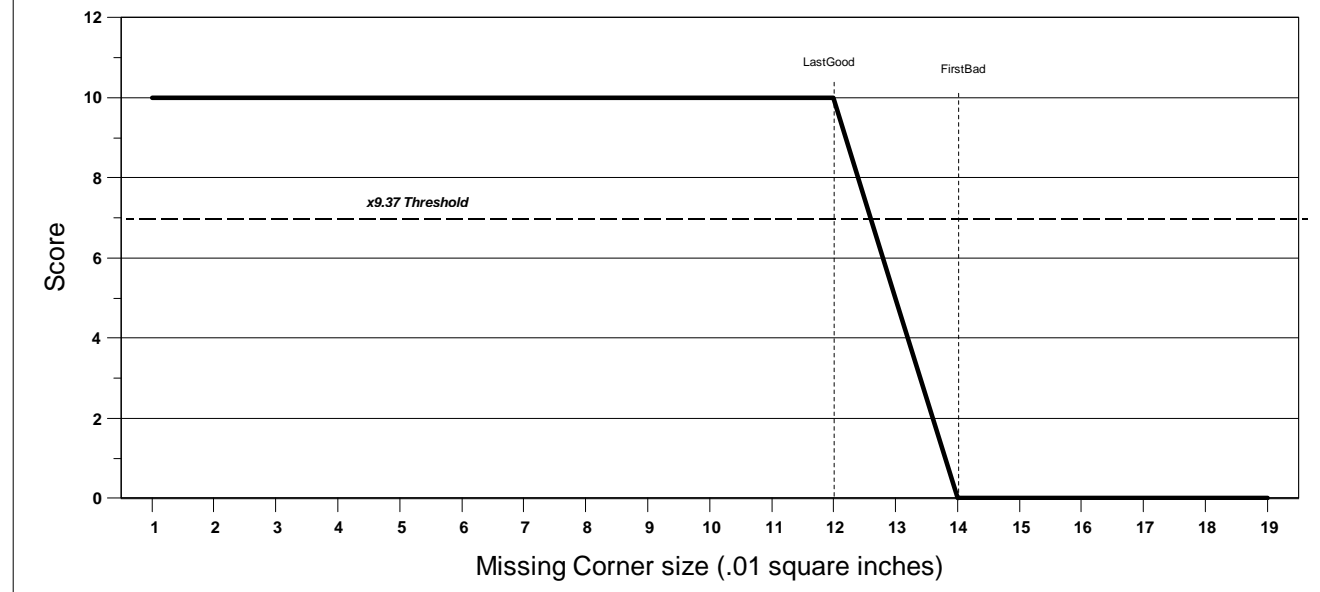


In the chart above, the white square at the upper left corner of the image shows how the square for the missing corner test is generated.

For scoring each corner, we perform a transform as illustrated in the following chart:



### Example of Missing Corner Scoring Calculation



In the chart above, the items that the user can set are:

- X9.37 threshold (set to 7.0 in this example)
- LastGood (set to 14/100 square inch in this example)
- FirstBad (set to 12/100 square inch in this example)
- The Exponent in this case (which controls the shape of the line between the LastGood and FirstBad parameters) is set to '1'.
- Any item that has an area measurement of between 1/100 square inches and about 12.8/100 square inches will pass the test with the given parameters. The test will be scored as a "pass" whenever the area measurement size is within the passing region.

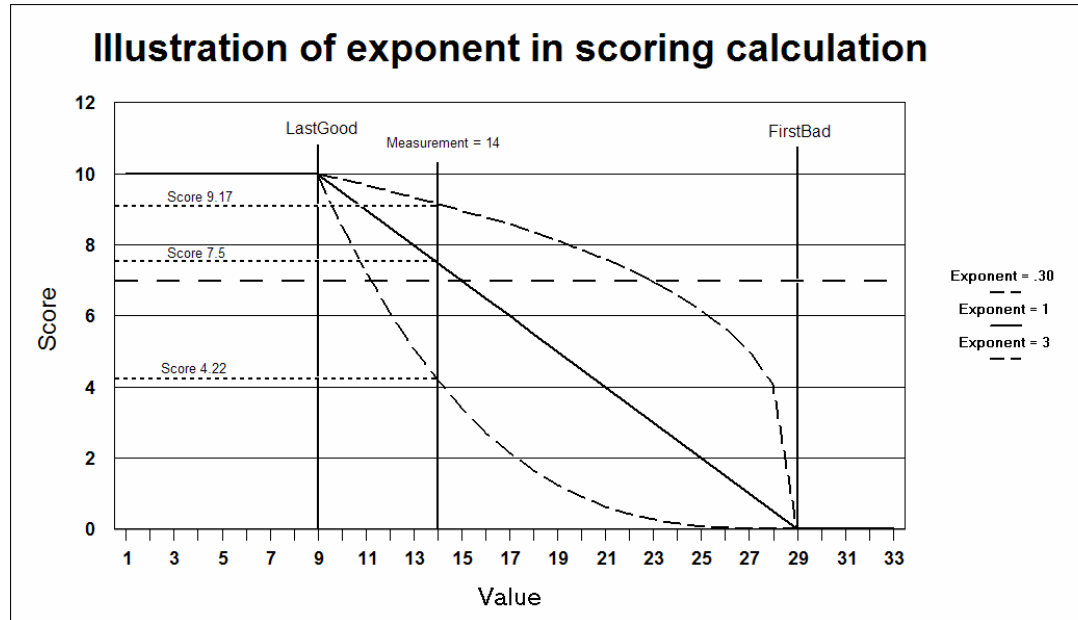
In addition to the items shown above, the shape line between the LastGood and FirstBad elements may be set by the Exponent value.

The "Last Good" parameter is the point beyond which the judgment of the measurement results begins to decrease from a "10.0". The "First Bad" parameter beyond which the measurement results will be a "0.0". The "direction" from "Last Good" to "First Bad" is determined by the relative size of the two parameters. If the "LastGood" is less than "First Bad", then the score will get worse as its measurement grows from the "LastGood" measurement point. If "FirstBad" is less than "LastGood", then the score will get better as its measurement grows from the "FirstBad" measurement point.

The scoring of items with values that fall between the relevant "LastGood" and "FirstBad" values is performed in

two steps:

- The first step generates the preliminary score, which is a linear interpolation between the LastGood and FirstBad elements. This preliminary score is normalized to a value of between 0 and 1.
- After the preliminary score is calculated, it is finalized by raising that score to the value of the Exponent and multiplied by 10 to yield the final result. This results in a curved shape of the score. An example of this scoring method is shown in the following diagram:



For this example, we have a “LastGood” value of 9 and a “FirstBad” value of 29. If the user selects an exponent value for this measurement of ‘1’, we see the linear slope between the “LastGood” point and the “FirstBad” point. If the exponent is other than 1, we see an exponential curve between the two points. For this particular example, with a measured value of 14, we score the result as 9.17 with an exponent value of .3. It scores as a 7.5 with an exponent value of 1, and it scores 4.22 with an exponent value of 3. If the score value is at or above the  $x9.37$ Threshold value of 7, then the test is graded as a **“pass”**. If the score value is below the  $x9.37$ Threshold, then the test is graded as a **“fail”**.

3	Restrictions & Intellectual Property	
3.1	Are there any known restrictions in the use of the submitted check image test and related technology (technical, performance, legal, business, platform, etc.)?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes - <i>please provide details:</i>
3.2	Are proprietary Intellectual Property (IP) rights in the form of Patents associated with the description and use of the submitted check image test?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes – <i>Please provide patent and/or patent application numbers and indicate who owns the IP. Also provide evidence that the patent holder agrees to comply with the X9 Procedures including the X9 patent policy:</i>
3.3	Are proprietary Intellectual Property (IP) rights in the form of proprietary material and/or other intellectual property (e.g. specific to a vendor tool, device, or product) associated with the description and use of the submitted check image test?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes – <i>Please provide evidence that the owner agrees to provide the Proprietary IP Holder Statement contained in Annex B of ANS X9.100-40-2006 Part 2:</i>

**Notice:** By accepting a check image test for registration, ASC X9 is not endorsing, certifying validity, certifying performance, nor providing any warranty for the registered check image test. The organization using the test shall determine which test(s) to use based on their own business needs, perceived benefit, and validation/assessment of any test results provided by the check image test supplier, their own testing, or a third party.